TEST REPORT

Product Name : Camera Hub G5 Pro (Wi-Fi)
Model Number : CH-C07E, CH-C07D

Prepared for	:	Lumi United Technology Co., Ltd.
Address	:	Room 801-804, Building 1, Chongwen Park, Nanshan iPark, No. 3370, Liuxian Avenue, Fuguang Community, Taoyuan Residential District, Nanshan District, Shenzhen, China
Prepared by	:	EMTEK (SHENZHEN) CO., LTD.
Address	:	Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China Tel: (0755) 26954280 Fax: (0755) 26954282
Report Number	:	ENS2411080085W02303R
Date(s) of Tests	:	November 12, 2024 to November 20, 2024
Date of Issue	:	November 23, 2024

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Modified Information

Version	Report No.	Revision Date	Summary
	ENS2411080085W02303R	/	Original Report

1. TEST RESULT CERTIFICATION

Applicant	:	Lumi United Technology Co., Ltd.
Address	:	Room 801-804, Building 1, Chongwen Park, Nanshan iPark, No. 3370, Liuxian Avenue, Fuguang Community, Taoyuan Residential District, Nanshan District, Shenzhen, China
Manufacturer	:	Lumi United Technology Co., Ltd.
Address	:	Room 801-804, Building 1, Chongwen Park, Nanshan iPark, No. 3370, Liuxian Avenue, Fuguang Community, Taoyuan Residential District, Nanshan District, Shenzhen, China
EUT	:	Camera Hub G5 Pro (Wi-Fi)
Model Name	:	CH-C07E, CH-C07D
Trademark	:	Aqara

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
ETSI EN 301 893 V2.1.1: 2017	PASS
AS/NZS 4268: 2017 Amd 1:2021	PASS

The device described above is tested by EMTEK(SHENZHEN) CO., LTD. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and EMTEK(SHENZHEN) CO., LTD. is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment under Test) is technically compliant with the above table standards requirement.

This report applies to above tested sample only and shall not be reproduced in part without written approval of EMTEK (SHENZHEN) CO., LTD.

Date of Test	:	November 12, 2024 to November 20, 2024
Prepared by	:	Una Yu/Editor
Reviewer	:	Joe Xia/Supervisor
Approved & Authorized Signer	:	Lisa Wang/Manager

2. EUT DESCRIPTION

Product Name:	Camera Hub G5 Pro (Wi-Fi)
Model Number:	CH-C07E, CH-C07D
WIFI Type:	WIFI 5G with 5150~5250MHz Band
WLAN Supported:	IEEE 802.11a IEEE 802.11n(20MHz channel bandwidth) IEEE 802.11n(40MHz channel bandwidth) IEEE 802.11ac(20MHz channel bandwidth) IEEE 802.11ac(40MHz channel bandwidth) IEEE 802.11ac(80MHz channel bandwidth)
Frequency Range:	5150MHz-5250MHz Band: 5180-5240MHz for 802.11a 5180-5240MHz for 802.11n(20) 5190-5230MHz for 802.11n(40) 5180-5240MHz for 802.11ac(20) 5190-5230MHz for 802.11ac(40) 5210MHz for 802.11ac(80)
Modulation:	IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) IEEE 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
DFS Function:	Not Support
TPC Function:	Not Support
Beamforming:	Not Support
Smart System:	SISO
Antenna Type:	FPC Antenna
Antenna Gain:	0.5 dBi
Power Supply:	5V 2A
Temperature Range:	-30~+50℃

Note: For more details, please refer to the user's manual of the EUT.

3. SUMMARY OF TEST RESULT

Clause (EN 301893)	Test Parameter	Verdict	Remark
4.2.1	Carrier Frequencies	PASS	
4.2.2	Occupied Channel Bandwidth	PASS	
4.2.3	RF Output Power at the highest power level	PASS	
4.2.3	RF Output Power at the lowest power level with TPC	PASS	
4.2.3	Power Density at the highest power level	PASS	
4.2.4.1	Transmitter Unwanted Emissions Outside the 5GHz RLAN Bands	PASS	
4.2.4.2	Transmitter Unwanted Emissions Within the 5GHz RLAN Bands	PASS	
4.2.5	Receiver Spurious Emissions	PASS	
4.2.6	Dynamic Frequency Selection (DFS)	N/A (See Note1)	
4.2.7	Adaptivity	PASS	
4.2.8	Receiver Blocking	PASS	
4.2.9	User Access Restrictions	PASS	
4.2.10	Geo-location capability	N/A (See Note2)	

NOTE 1: Please refer to the DFS report.
NOTE 2: Only applicable for have Geo-location function equipment.
NOTE 3: The product only supports OFDMA full RU tone, so only the data of full RU are shown in the report.

4. TEST METHODOLOGY

4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards: ETSI EN 301 893 –Broadband Radio Access Networks (BRAN); 5GHz high performance RLAN; Harmonized EN covering the essential requirements of article 3.2 of the RED Directive.

4.2 MEASUREMENT EQUIPMENT USED

For Spurious Emissions Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Pre-Amplifier	Bonn	BLMA 011001N	2213967A	2023/10/23	1Year
EMI Test Receiver	Rohde & Schwarz	ESR7	102551	2023/10/23	1Year
Bilog Antenna	Schwarzbeck	VULB9163	9163142	2024/7/8	2Year
Horn antenna	Schwarzbeck	BBHA9120D	9120D-1198	2023/6/2	2Year
Pre-Amplifier	Bonn	BLMA 0118-5G	2213967B-01	2023/10/23	1Year
Spectrum Analyzer	Rohde & Schwarz	FSV3044	101290	2023/10/23	1Year
Horn antenna	Schwarzbeck	BBHA9170	9170-399	2023/5/12	2Year
Pre-Amplifier	Lunar EM	LNA18G26-40	J1012131010001	2024/5/11	1Year
Pre-Amplifier	Lunar EM	LNA26G40-40	J1013131028001	2024/5/11	1Year
Loop Antenna	Schwarzbeck	FMZB1519	1519-012	2023/5/12	2Year

For Other Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Wideband Radio Communication Tester	R&S	CMW500	171168	2024/9/18	1Year
Frequency Extender	R&S	CMW-Z800A	100430	2024/9/18	1Year
Analog Signal Generator	R&S	SMB100A	183237	2024/9/18	1Year
Vector Signal Generator	R&S	SMM100A	101808	2024/9/18	1Year
RF Control Unit(Power Meter)	Tonscend	JS0806-2	22C8060567	2024/9/18	1Year
Temperature&Humidity Chamber	ESPEC	EL-02KA	12107166	2024/5/10	1 Year

4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.
The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.
The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.
Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.
Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

WIFI 5G with 5150-5250MHz

Frequency and Channels list for 802.11a/n(20)/ac(20)/ax(20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	44	5220		
40	5200	48	5240		

Frequency and Channels list for 802.11n (40)/ac(40)/ax(40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
38	5190				
46	5230				

Frequency and Channel list for 802.11ac(80)/ax(80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
42	5210				

Test Frequency and Channels for 802.11a/n(20)/ac(20)/ax(20):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	40	5200	48	5240

Test Frequency and channels for 802.11n (40)/ac(40)/ax(40):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
38	5190	N/A	N/A	46	5230

Test Frequency and channels for 802.11ac(80)/ax(80):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
42	5210	N/A	N/A	N/A	N/A

WIFI 5G with 5250-5350MHz

Frequency and Channels list for 802.11a/n(20)/802.11ac(20)/802.11ax(20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	60	5300		
56	5280	64	5320		

Frequency and Channels list for 802.11n (40)/802.11ac(40)/802.11ax(40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
54	5270				
62	5310				

Frequency and Channels list for 802.11ac(80)/802.11ax(80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
58	5290				

Test Frequency and Channels for 802.11a/n(20)/802.11ac(20)/802.11ax(20):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	56	5280	64	5320

Test Frequency and channels for 802.11n (40)/802.11ac(40)/802.11ax(40):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
54	5270	N/A	N/A	62	5310

Test Frequency and channels for 802.11ac(80)/802.11ax(80):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
58	5290				

WIFI 5G with 5470-5725MHz

Frequency and Channels list for 802.11a/n(20)/802.11ac(20)/802.11ax(20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	116	5580	132	5660
104	5520	120	5600	136	5680
108	5540	124	5620	140	5700
112	5560	128	5640		

Frequency and Channels list for 802.11n (40)/802.11ac(40)/802.11ax(40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
102	5510	118	5590	134	5670
110	5550	126	5630		

Frequency and Channels list for 802.11ac(80)/802.11ax(80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
106	5530	122	5610		

Test Frequency and Channels for 802.11a/n(20)/802.11ac(20)/802.11ax(20):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	116	5580	140	5700

Test Frequency and channels for 802.11n (40)/802.11ac(40)/802.11ax(40):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
102	5510			134	5670

Test Frequency and channels for 802.11ac(80)/802.11ax(80):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
106	5530	122	5610		

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

Bldg 69, Majialong Industry Zone District, Nanshan District, Shenzhen, China
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description		
Name of Firm	:	EMTEK (SHENZHEN) CO., LTD.
Site Location	:	Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China

6. TEST SYSTEM UNCERTAINTY

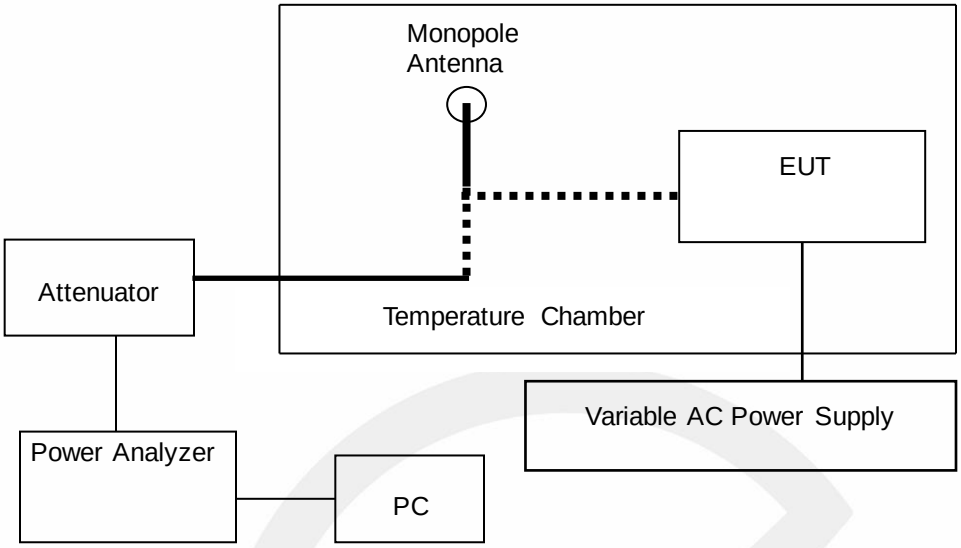
Maximum measurement uncertainty of the test system

Test Parameter	measurement uncertainty
RF Output Power	±1.0%
Power Spectral Density	±0.9%
Frequency Error	±3.3%
Occupied Channel Bandwidth	±2.3%
Transmitter Unwanted Emission in the Out-of Band	±1.2%
Transmitter Unwanted Emissions in the Spurious Domain	±2.7%
Receiver Spurious Emissions	±2.7%
Temperature	±3.2%
Humidity	±2.5%

7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

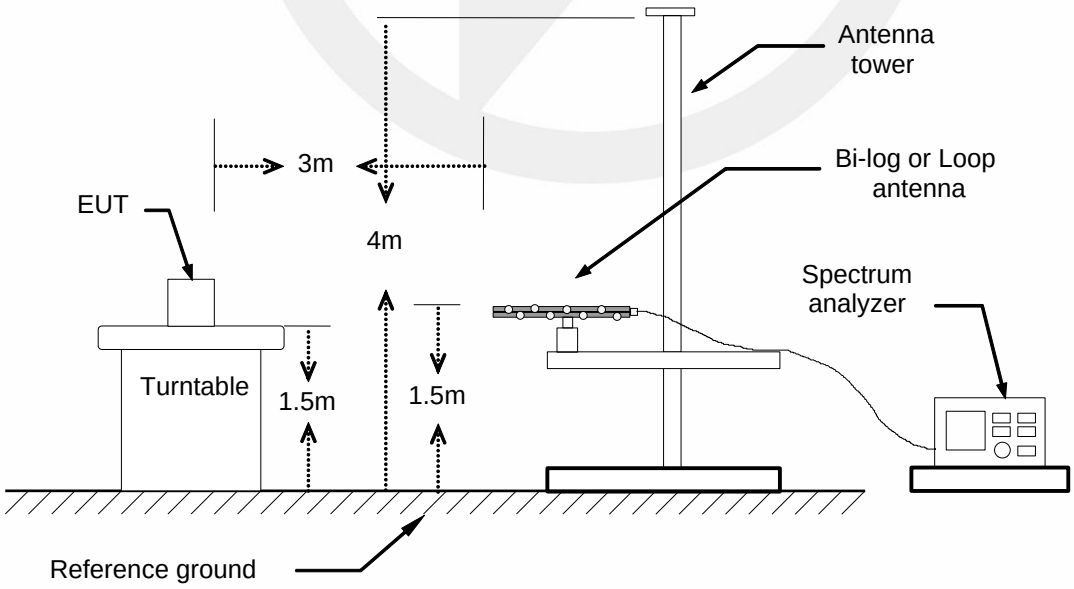
Conducted measurements configuration of EUT shall be as follows:



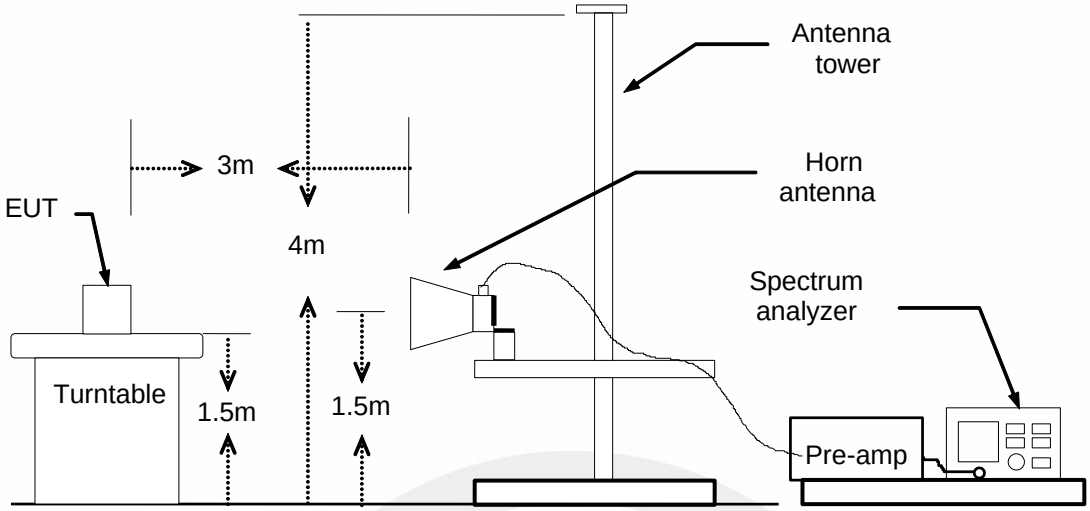
Remarks:
The Signal Analyzer could be connected to a monopole antenna or directly connected to the EUT, if the EUT has already employing an antenna connector.

Radiated measurements configuration of EUT shall be as follows:

Below 1GHz



Above 1GHz



7.2 SUPPORT EQUIPMENT

N/A

Notes:

1.All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2.Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

8. ETSI EN 301 893 REQUIREMENTS

8.1 CARRIER FREQUENCIES MEASUREMENT

8.1.1 Applicable standard

ETSI EN 301 893 clause 4.2.1

8.1.2 Conformance Limit

The actual centre frequency for any given channel declared by the manufacturer shall be maintained within the range fc ± 20 ppm.

8.1.3 Test Configuration

The measurements for Carrier Frequencies Measurement shall be performed at both normal environmental conditions and at the extremes of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.
Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s)

8.1.4 Test Procedure

Please refer to ETSI EN 301 893 (V2.1.1) clause 5.4.2.2&5.4.2.1 for the measurement method.

- Equipment operating without modulation

This test method requires that the UUT can be operated in an unmodulated test mode.
The UUT shall be connected to a frequency counter and operated in an unmodulated mode. The result shall be recorded.

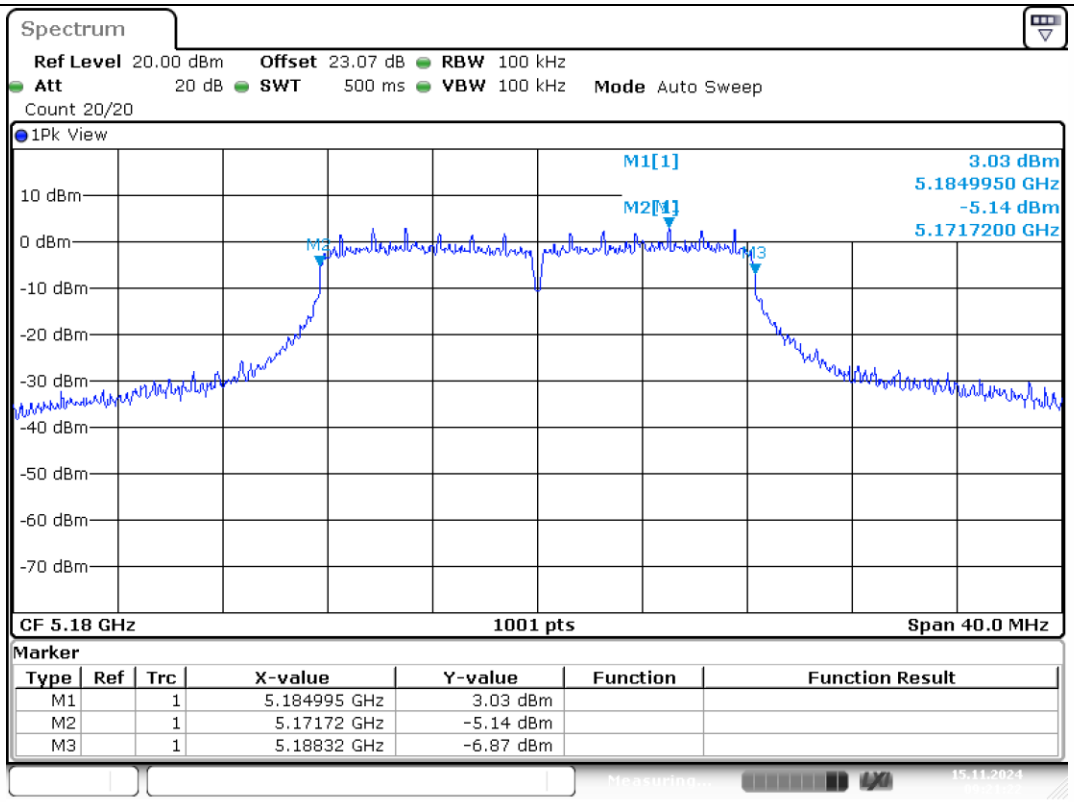
- Equipment operating with modulation

This method is an alternative to the above method in case the UUT cannot be operated in an un-modulated mode.
The UUT shall be connected to spectrum analyser.
The settings of the spectrum analyser shall be adjusted to optimize the instruments frequency accuracy.
Max Hold shall be selected and the centre frequency adjusted to that of the UUT.
The peak value of the power envelope shall be measured and noted. The span shall be reduced and the marker moved in a positive frequency increment until the upper, (relative to the centre frequency), -10 dBc point is reached. This value shall be noted as f1.
The marker shall then be moved in a negative frequency increment until the lower, (relative to the centre frequency), -10 dBc point is reached. This value shall be noted as f2.
The centre frequency is calculated as (f1 + f2) / 2.

8.1.5 Test Results

NOTE: All the modulation modes are tested, the data of the worst mode are described in the table.

Test Condition	TestMode	Antenna	Frequency[MHz]	Result[ppm]	Limit[ppm]	Verdict
NTNV	11A	Ant1	5180	3.86100	±20	PASS
NTNV	11N20SISO	Ant1	5180	-3.86100	±20	PASS
NTNV	11N40SISO	Ant1	5190	0.00000	±20	PASS
NTNV	11AC20SISO	Ant1	5180	-3.86100	±20	PASS
NTNV	11AC40SISO	Ant1	5190	0.00000	±20	PASS
NTNV	11AC80SISO	Ant1	5210	0.00000	±20	PASS



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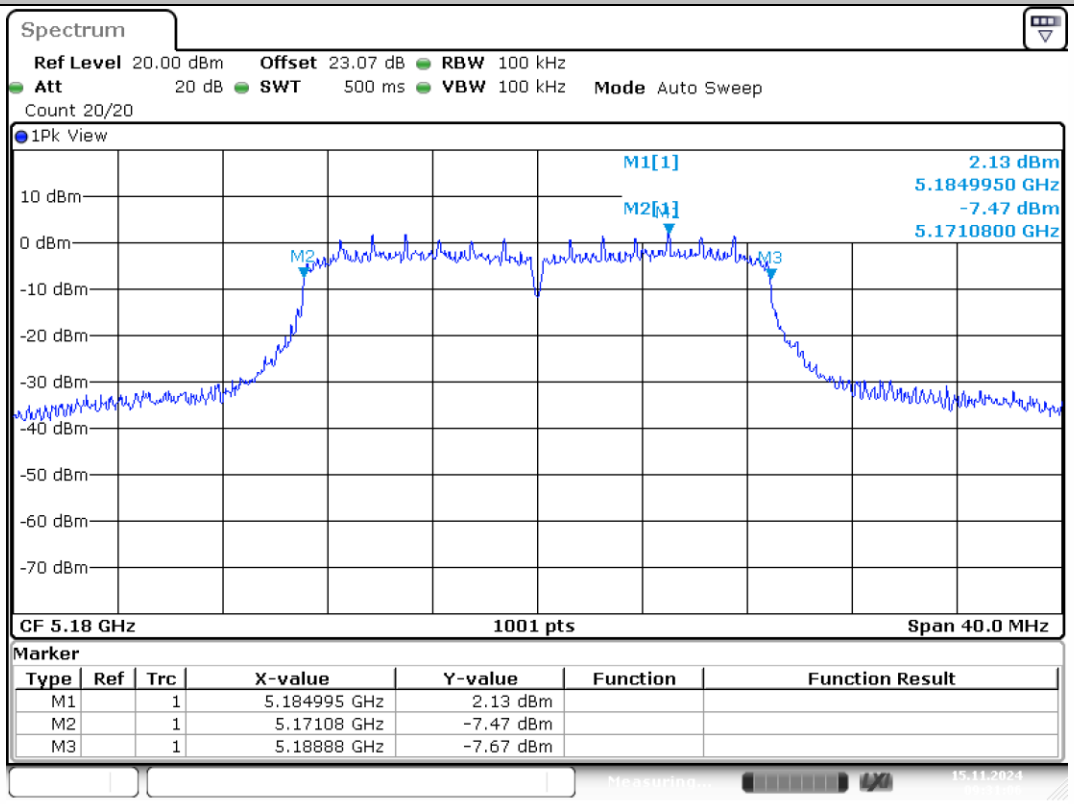

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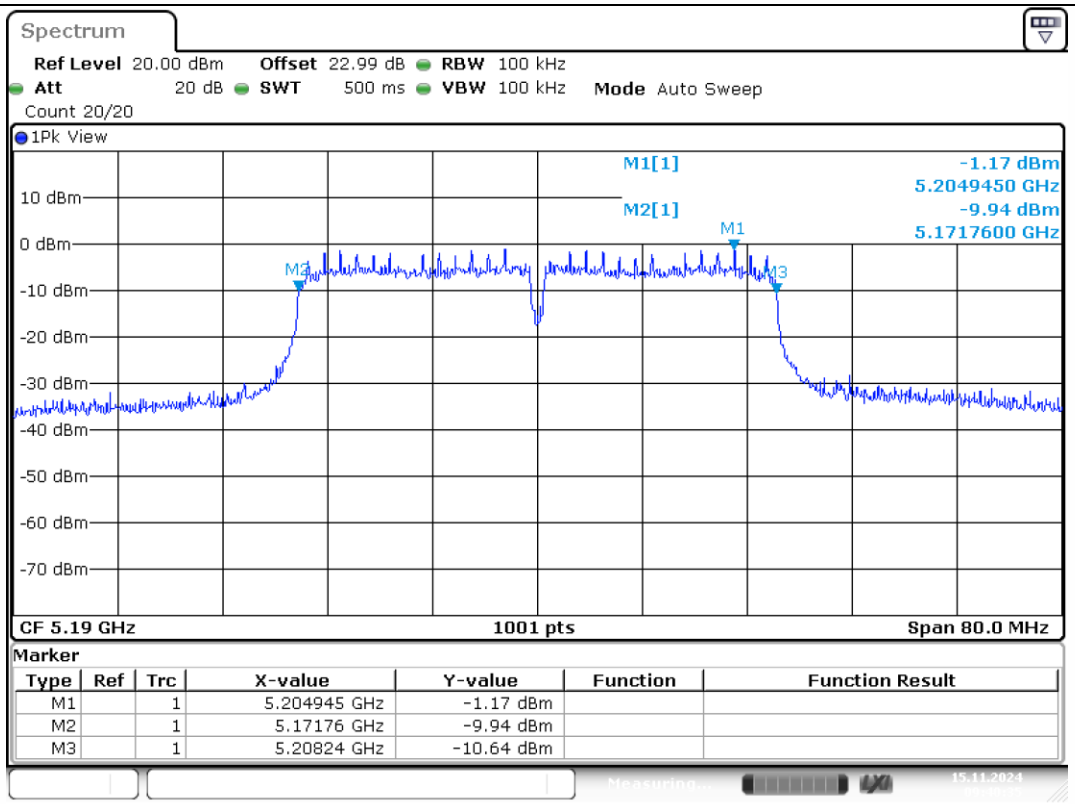

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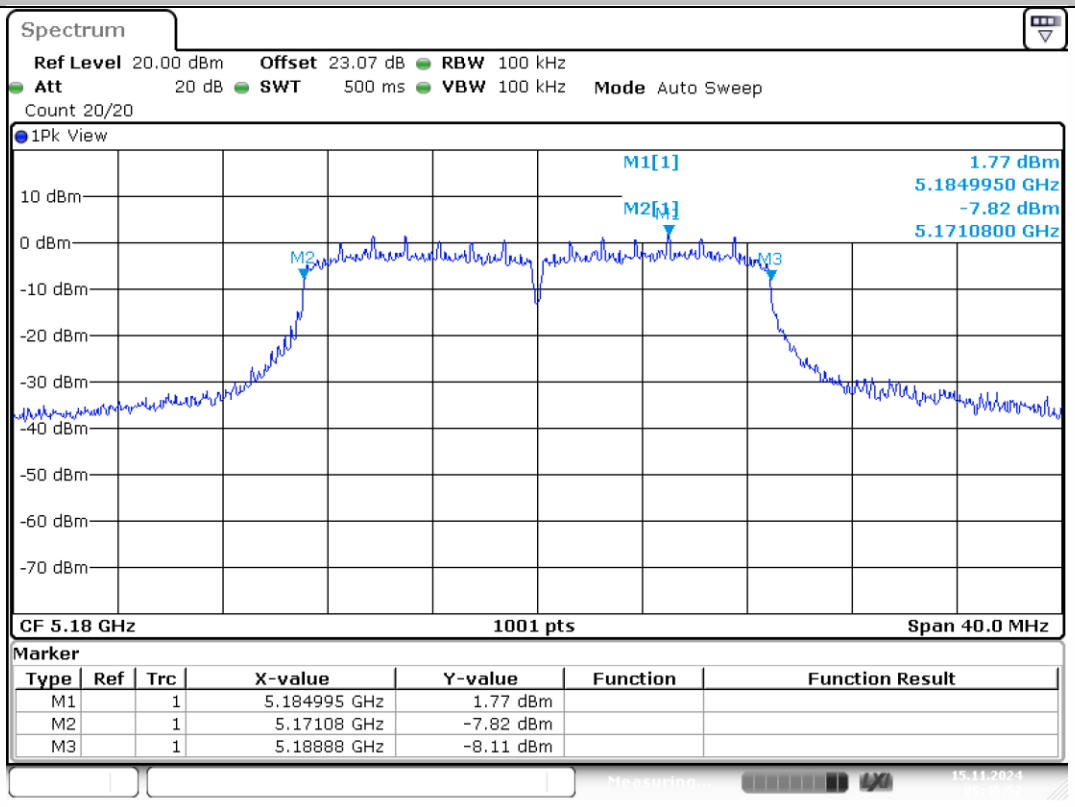

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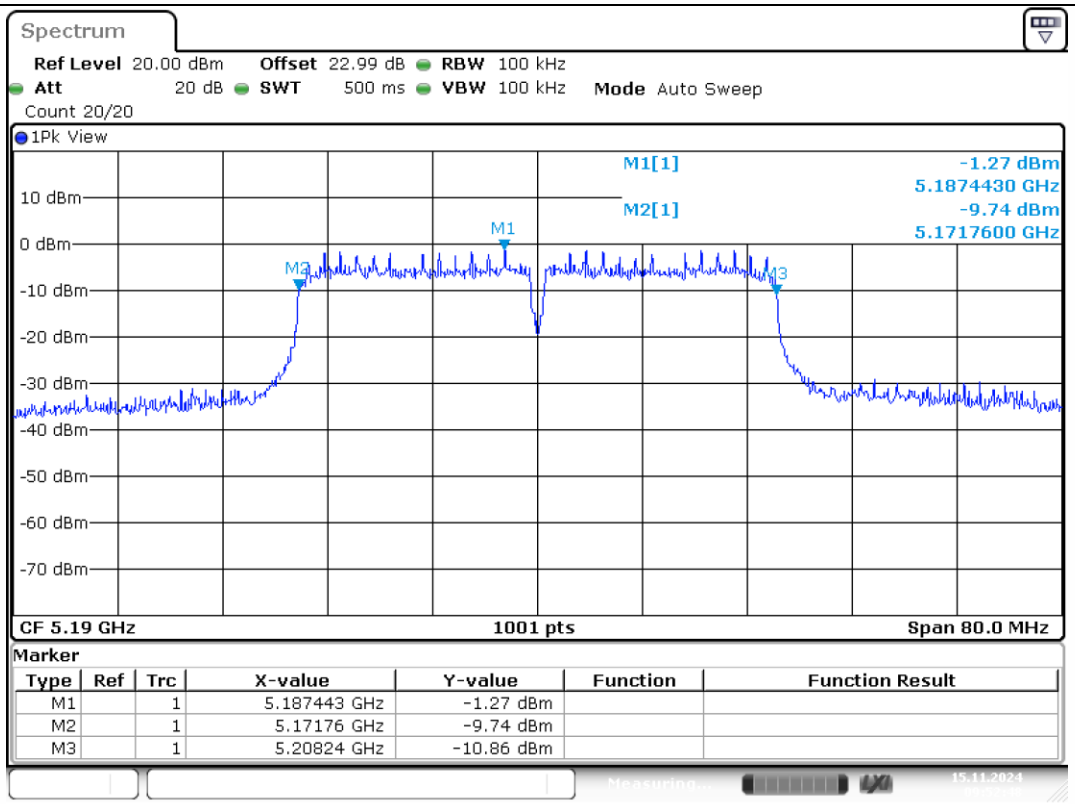

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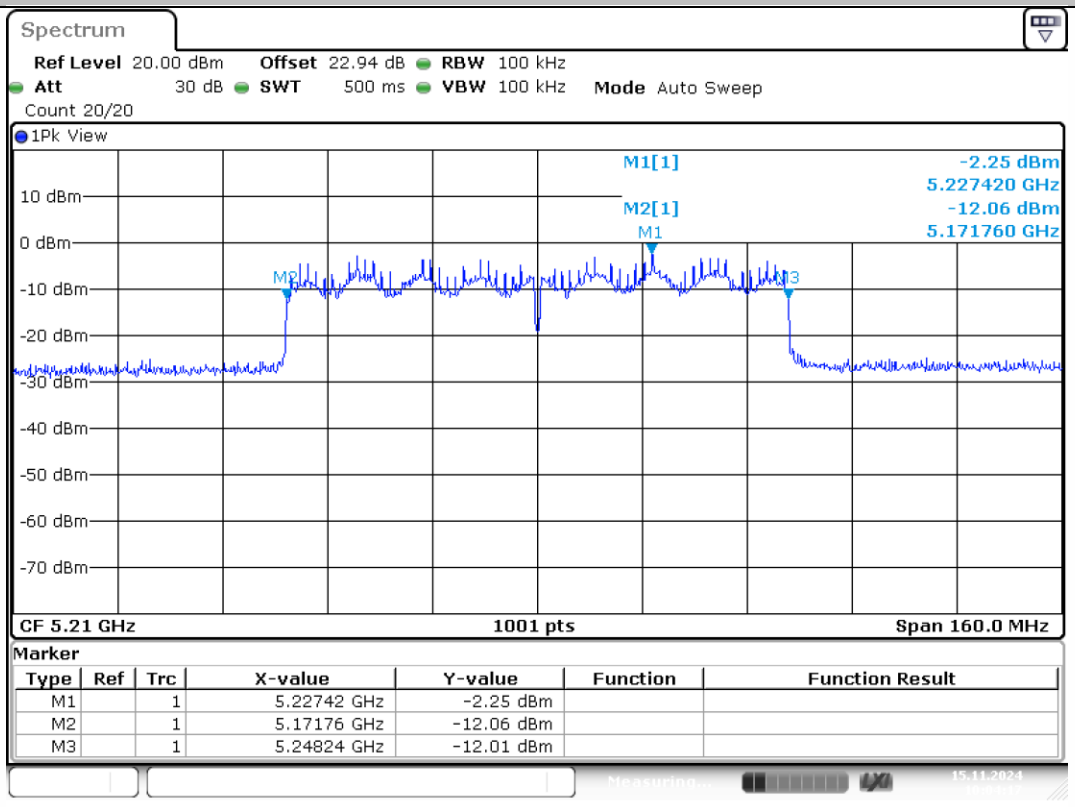

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NTNV-11AC80SISO-Ant1-5210-PASS

8.2 OCCUPIED CHANNEL BANDWIDTH

8.2.1 Applicable standard

ETSI EN 301 893 clause 4.2.3

8.2.2 Conformance Limit

The Nominal Channel Bandwidth for a single Operating Channel shall be 20 MHz.
Alternatively, equipment may implement a lower Nominal Channel Bandwidth with a minimum of 5 MHz, providing they still comply with the Nominal Centre Frequencies defined in clause 4.2.1 (20 MHz raster).
The Occupied Channel Bandwidth shall be between 80 % and 100 % of the Nominal Channel Bandwidth.
In case of smart antenna systems (devices with multiple transmit chains) each of the transmit chains shall meet this requirement.
The Occupied Channel Bandwidth might change with time/payload.
During a Channel Occupancy Time (COT), equipment may operate temporarily with an Occupied Channel Bandwidth of less than 80 % of its Nominal Channel Bandwidth with a minimum of 2 MHz.

8.2.3 Test Configuration

The measurements for Occupied Channel Bandwidth shall be performed at normal environmental conditions of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.2.4 Test Procedure

Please refer to ETSI EN 301 893 (V2.1.1) clause 5.4.3.1 & 5.4.3.2 for the measurement method.

The measurement procedure shall be as follows:

Step 1:

• Connect the UUT to the spectrum analyser and use the following settings:

- Centre Frequency: The centre frequency of the channel under test

- Resolution Bandwidth: 100 kHz

- Video Bandwidth: 300 kHz

- Frequency Span: 2 × Nominal Bandwidth (e.g. 40 MHz for a 20 MHz channel)

- Detector Mode: Peak

- Trace Mode: Max Hold

Step 2:

• When the trace is complete, capture the trace, for example using the "View" option on the spectrum analyser.

• Find the peak value of the trace and place the analyser marker on this peak.

Step 3:

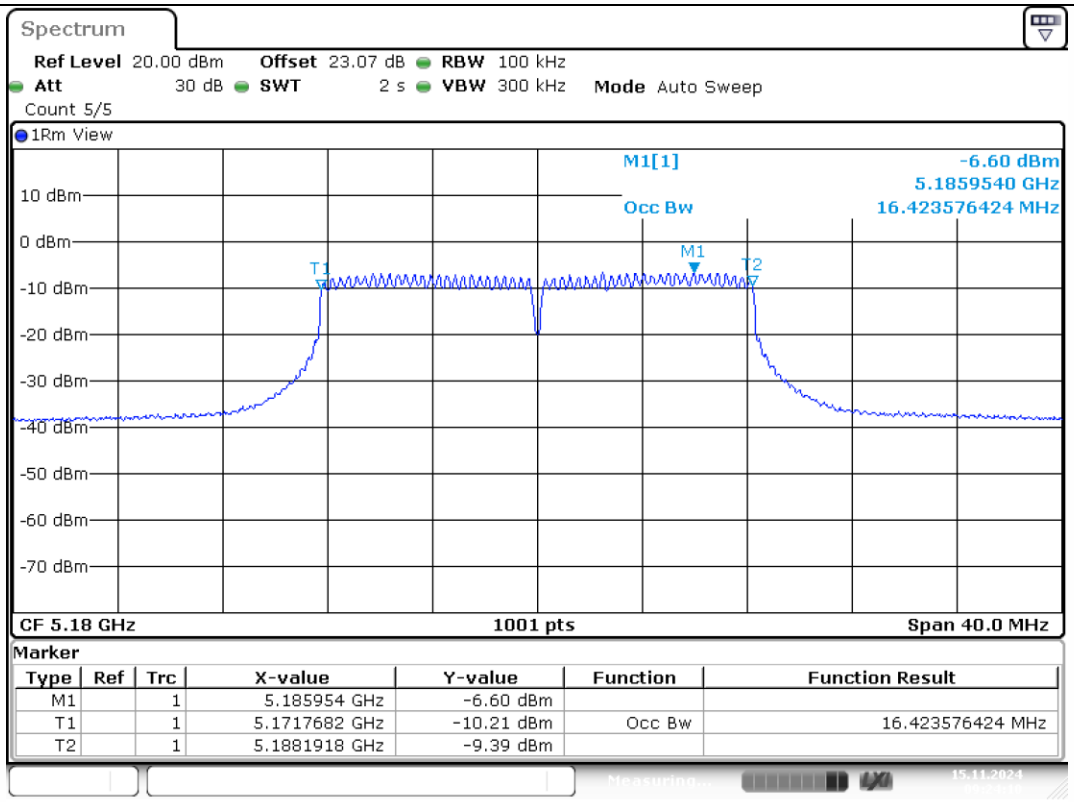
• Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.

The measurement described in steps 1 to 3 above shall be repeated in case of simultaneous transmissions in non-adjacent channels.

8.2.5 Test Results

NOTE: All the modulation modes are tested, the data of the worst mode are described in the table.

TestMode	Antenna	Frequency[MHz]	OCB[MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	16.424	16 to 20	PASS
11N20SISO	Ant1	5180	17.622	16 to 20	PASS
11N40SISO	Ant1	5190	36.284	32 to 40	PASS
11AC20SISO	Ant1	5180	17.622	16 to 20	PASS
11AC40SISO	Ant1	5190	36.284	32 to 40	PASS
11AC80SISO	Ant1	5210	75.285	64 to 80	PASS



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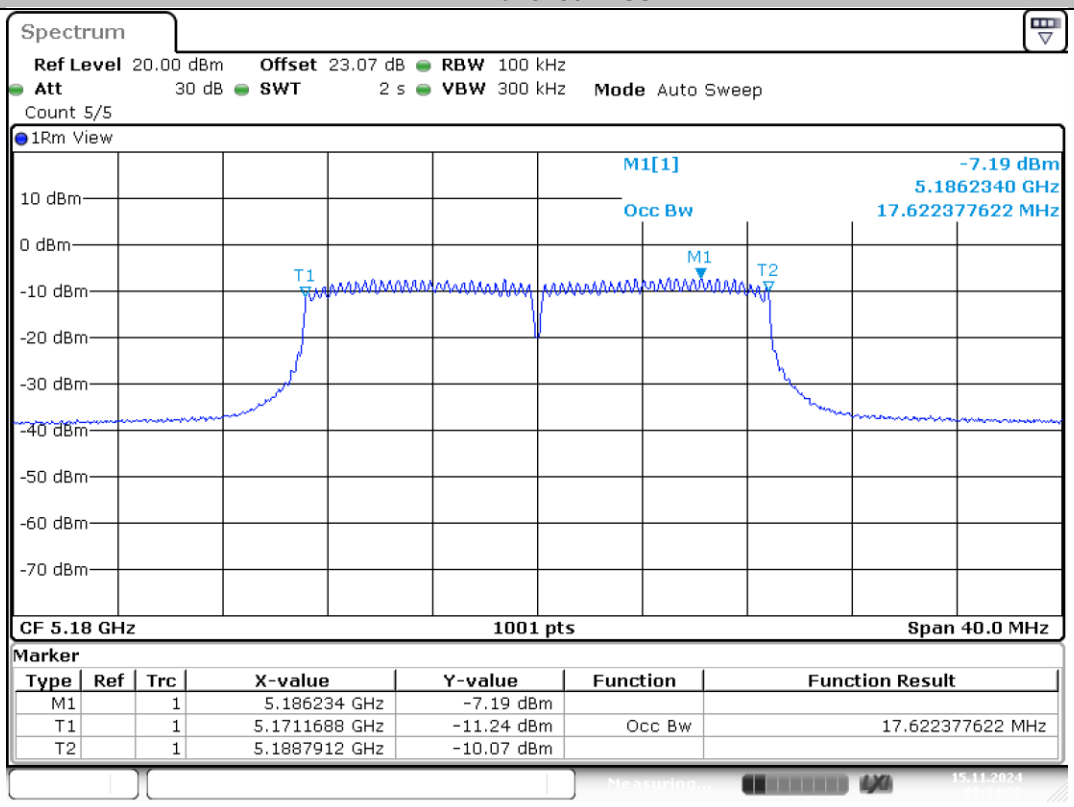

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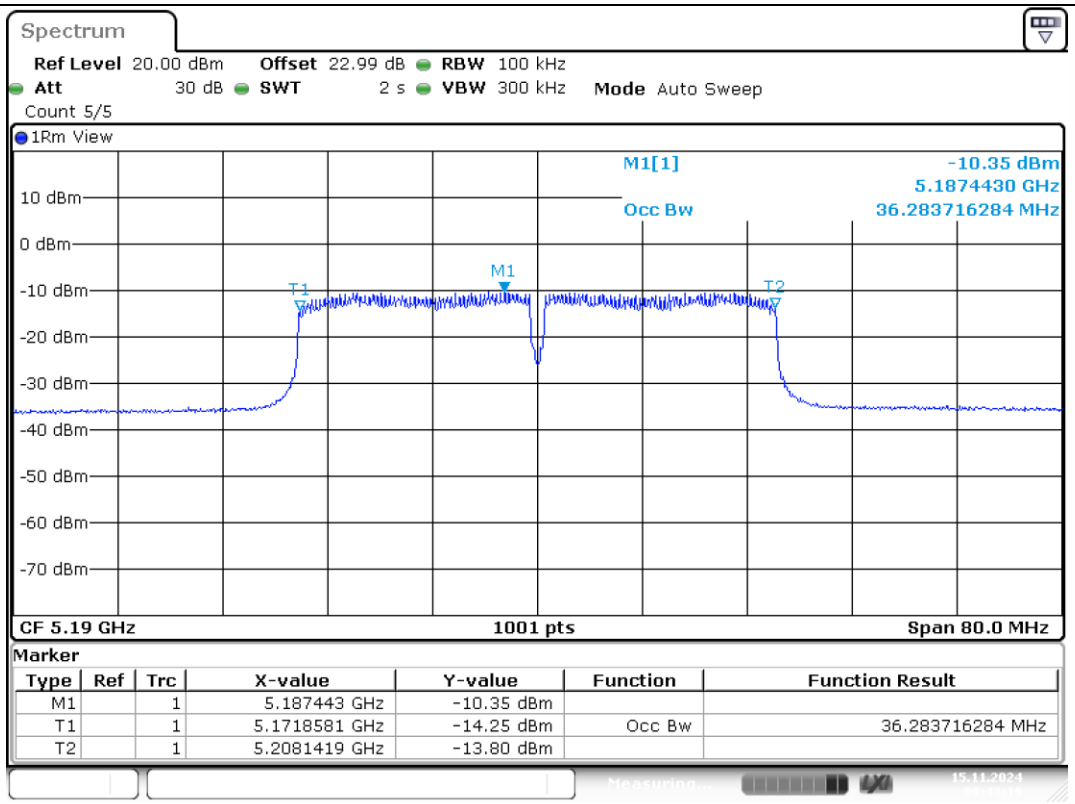

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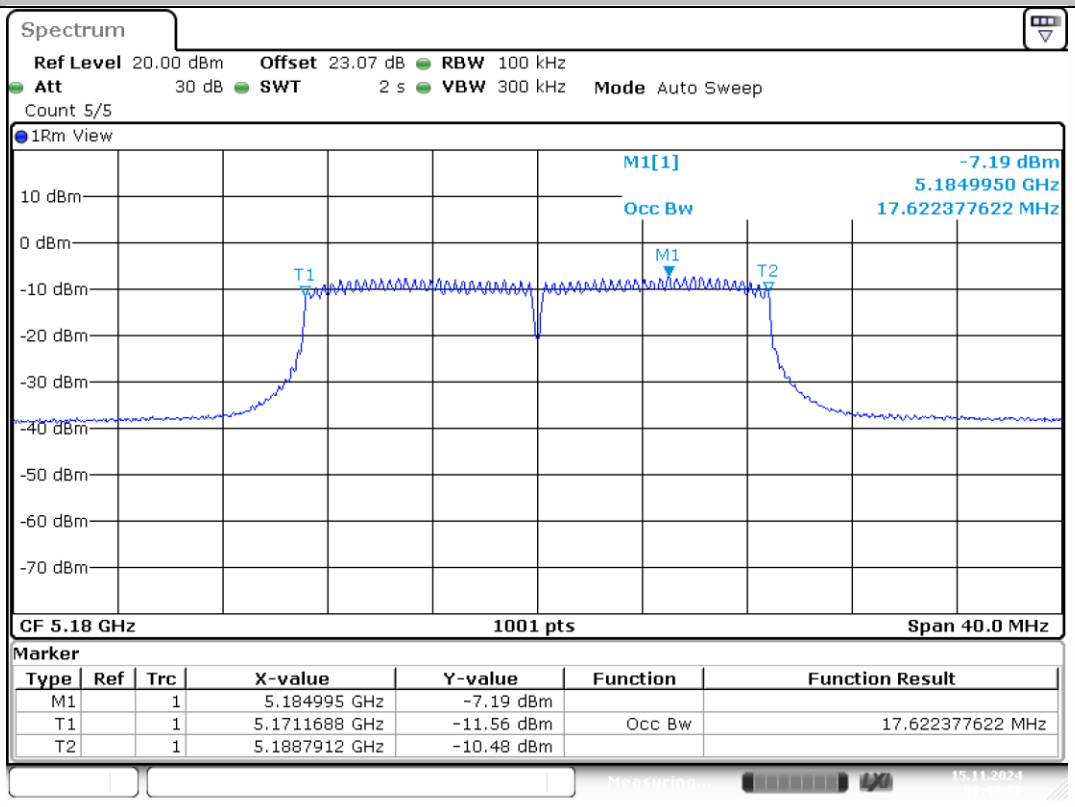

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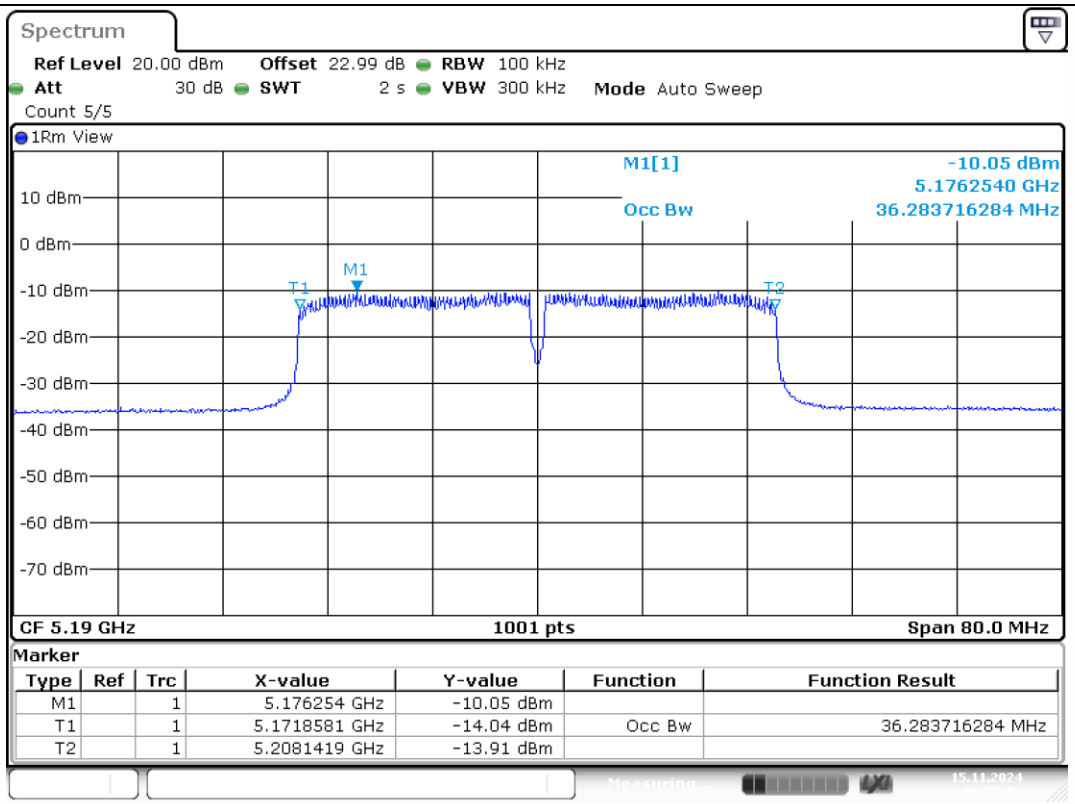

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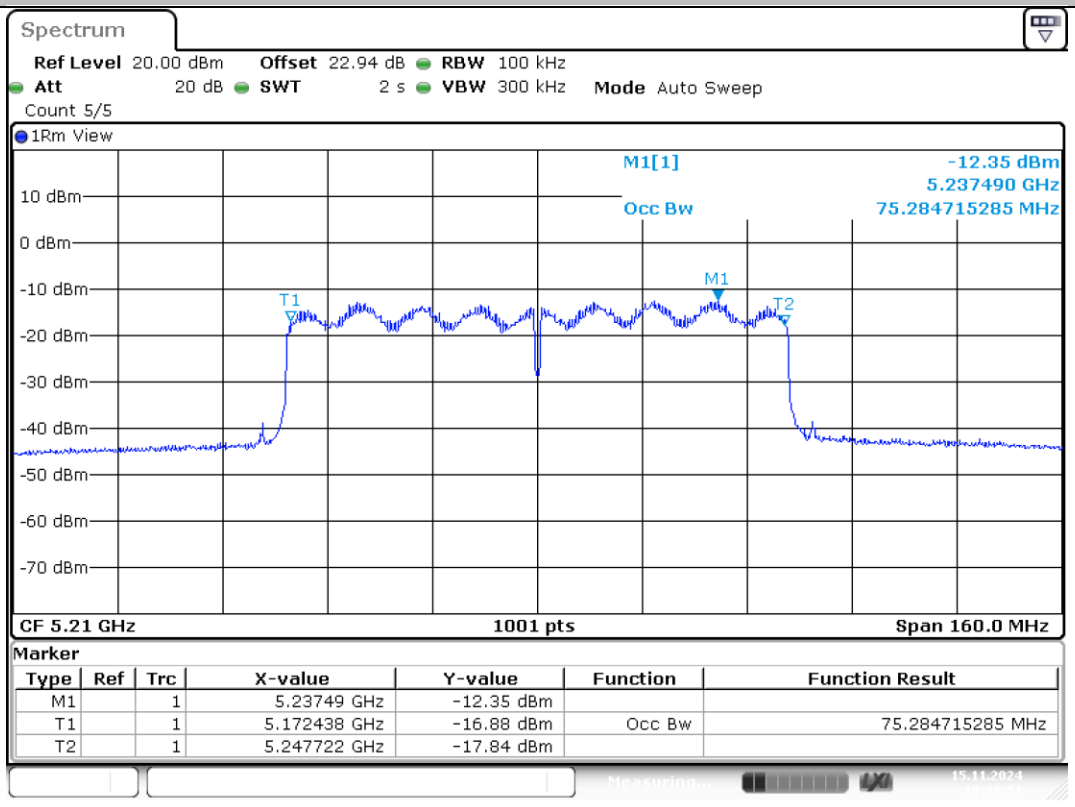

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8.3 RF OUTPUT POWER AT THE HIGHEST POWER LEVEL

8.3.1 Applicable standard

ETSI EN 301 893 Clause 4.2.3

8.3.2 Conformance Limit

RF Output Power <= (23 dBm) mean EIRP for 5150-5250MHz under both Normal and Extreme test conditions.

RF Output Power <= (20 dBm) mean EIRP for 5250-5350MHz without TPC under both Normal and Extreme test conditions.

RF Output Power <= (23 dBm) mean EIRP for 5250-5350MHz with TPC under both Normal and Extreme test conditions.

RF Output Power <= (30 dBm) mean EIRP for 5470-5725MHz with TPC under both Normal and Extreme test conditions.

RF Output Power <= (27 dBm) mean EIRP for 5470-5725MHz without TPC under both Normal and Extreme test conditions.

RF Output Power <= (23dBm) mean EIRP for 5470-5725MHz with TPC slave devices without a Radar Interference Detection function under both Normal and Extreme test conditions.

RF Output Power <= (20dBm) mean EIRP for 5470-5725MHz without TPC slave devices without a Radar Interference Detection function under both Normal and Extreme test conditions.

8.3.3 Test Configuration

The measurements for RF Output Power shall be performed at normal environmental conditions of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.
Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s) provided.

8.3.4 Test Procedure

Please refer to ETSI EN 301 893 (V2.1.1) clause 5.4.4.2 for the measurement method.

- Option 1: For equipment with continuous transmission capability or for equipment

operating (or with the capability to operate) with a constant duty cycle (e.g. Frame Based equipment)

This option is for equipment that operates only in one sub-band or that is capable for operation in 2 sub-bands simultaneously but, for the purpose of the testing, the equipment can be configured to:

• operate in a continuous transmit mode or with a constant duty cycle (x), and

• operate only in one sub-band.

Step 1:

For equipment configured into a continuous transmit mode (x = 1), proceed immediately with step 2.

• The output power of the transmitter shall be coupled to a matched diode detector or equivalent thereof. The output of the diode detector shall be connected to the vertical channel of an oscilloscope.

• The combination of the diode detector and the oscilloscope shall be capable of faithfully reproducing the duty cycle of the transmitter output signal.

• The observed duty cycle of the transmitter (Tx on / (Tx on + Tx off)) shall be noted as x ($0 < x \leq 1$), and

recorded in the test report.

Step 2:

• The RF output power shall be determined using a wideband RF power meter with a thermocouple detector or an equivalent thereof and with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be noted as "A" (in dBm).

• In case of conducted measurements on smart antenna systems operating in a mode with multiple transmit chains active simultaneously, the output power of each transmit chain shall be measured separately to calculate the total power (value "A" in dBm) for the UUT.

Step 3:

• The RF output power at the highest power level PH (e.i.r.p.) shall be calculated from the above measured power output A (in dBm), the observed duty cycle x, the stated antenna gain "G" in dBi and if applicable the beamforming gain "Y" in dB, according to the formula below. This value shall be recorded in the test report. If more than one antenna assembly is intended for this power setting or TPC range, the gain of the antenna assembly with the highest gain shall be used.

PH = A + G + Y + 10 log (1/x) (dBm).

• This value PH shall be compared to the applicable limit contained in table in table 2 of clause 4.2.3.2.2.

● Option 2: For equipment without continuous transmission capability and operating (or with the capability to operate) in only one sub-band This option is for equipment that is either:

• equipment capable of operation in both sub-bands, but not simultaneously; or

• equipment capable of operation in both sub-bands simultaneously but which, for the purpose of the testing, can be configured to transmit only in one sub-band.

Equipment having simultaneous transmissions in both sub-bands and which cannot be configured to transmit only in one sub-band, shall be tested using Option 3 given in clause 5.4.4.2.1.1.4.

The test procedure shall be as follows:

Step 1:

• Sample the transmit signal from the device using a fast power sensor suitable for 6 GHz. Save the raw samples. The samples must represent the RMS power of the signal.

• Settings:

- Sample speed: 1 MS/s or faster.

- Measurement duration: Sufficient to capture multiple transmitter bursts. (see clause 5.3.1.1).

Step 2:

• For conducted measurements on devices with multiple transmit chains:

- Sample all transmit ports simultaneously.

- Sum the power of all ports for each individual sample and save them. Use these summed samples in all following steps.

Step 3:

• Find the start and stop times of each burst in the stored measurement samples.

NOTE: The start and stop times are defined as the -20 dBc points of the RMS burst power.

Step 4:

• Between the start and stop times of each individual burst calculate the RMS (mean) power over the burst (Pburst). The highest of all Pburst values is the value "A" in dBm.

Step 5:

• The RF output power (e.i.r.p) at the highest power level "PH" shall be calculated from the above measured power output "A" (in dBm), the stated antenna assembly gain "G" in dBi and if applicable the beamforming gain "Y" in dB, according to the formula below. If more than one antenna assembly is intended for this power setting, the gain of the antenna assembly with the highest gain shall be used:

PH = A + G + Y (dBm).

• This value PH shall be compared to the applicable limit contained in table 2 of clause 4.2.3.2.2 and shall be recorded in the report.

● Option 3: For equipment without continuous transmission capability and having

simultaneous transmissions in both sub-bands This option is for equipment having simultaneous transmissions in both sub-bands but which cannot be configured to transmit only in one sub-band.

This procedure first measures the peak power in each sub-band separately, then measures the Peak to Mean Power ratio for the overall transmission and uses this to calculate the RF Output Power (e.i.r.p.) in each sub-band separately using the measured values for peak power.

The test procedure shall be as follows:

Step 1: Measuring the Total Peak Power within the lower sub-band.

• Connect the UUT to the spectrum analyser and use the following settings:

- Start Frequency: 5 100 MHz

- Stop Frequency: 5 400 MHz

- RBW: 1 MHz

- VBW: 3 MHz

- Detector Mode: Peak

- Trace Mode: Max Hold

- Sweep Time: Auto

• When the trace is complete, use the "Channel Power" function to measure the total peak power of the transmissions within the band 5 150 MHz to 5 350 MHz.

NOTE 1: Ensure that the noise floor of the spectrum analyser is at least 30 dB to 40 dB below the peak of the power envelope. If this is not possible (e.g. radiated measurements) reduce the bandwidth of the channel power function to a value which is still slightly above the Nominal Channel Bandwidth (e.g. +10 %) to avoid the noise floor influencing the measurement result.

• For conducted measurements on devices with multiple transmit chains, the procedure above shall be repeated for each of the active transmit chains. The results shall be summed to provide the total peak power of the transmissions within the band 5 150 MHz to 5 350 MHz.

Step 2: Measuring the Total Peak Power within the upper sub-band.

• Change the Start Frequency to 5 420 MHz and the Stop Frequency to 5 775 MHz.

• When the trace is complete, use the "Channel Power" function to measure the total peak power of all transmissions with the band 5 470 MHz to 5 725 MHz.

NOTE 2: Ensure that the noise floor of the spectrum analyser is at least 30 dB to 40 dB below the peak of the power envelope. If this is not possible (e.g. radiated measurements) reduce the bandwidth of the channel power function to a value which is still slightly above the Nominal Channel Bandwidth (e.g. +10 %) to avoid the noise floor influencing the measurement result.

• For conducted measurements on devices with multiple transmit chains, the procedure above shall be repeated for each of the active transmit chains. The results shall be summed to provide the total peak power of the transmissions within the band 5 470 MHz to 5 725 MHz.

Step 3: Calculating the Total Peak Power.

• Calculate the total peak power by adding the measured value for the band 5 150 MHz to 5 350 MHz in step 1 to the value measured for the band 5 470 MHz to 5 725 MHz in step 2.

NOTE 3: Modern spectrum analysers may be able to measure the peak power in both sub-bands in one measurement in which case step 1 and step 2 can be combined.

Step 4: Measuring Total Mean Output Power.

• Sample the transmit signal from the device using a fast power sensor suitable for 6 GHz. Save the raw samples. The samples must represent the RMS power of the signal.

• Settings:

- Sample speed: ⩾ 10^6 Samples/s.

- Measurement duration: Sufficient to capture multiple transmitter bursts. (see clause 5.3.1.1).

-For conducted measurements on devices with multiple transmit chains:

- Sample all transmit ports simultaneously.

- Sum the power of all ports for each individual sample and save them. Use these summed samples in all following steps.

• Find the start and stop times of each burst in the stored measurement samples.

NOTE 4: The start and stop times are defined as the -20 dBc points of the RMS burst power.

• Between the start and stop times of each individual burst calculate the RMS (mean) power over the burst (Pburst). The highest of all Pburst values is the Total Mean Output Power and this value will be used for further calculations.

Step 5: Calculating the Peak to Mean Power Ratio.

• Using the value for Total Peak Power calculated in step 3 and the highest value for Total Mean Output Power measured in step 4, calculate the Peak to Average Power ratio in dB.

Step 6: Calculating the RF Output Power (e.i.r.p.) for each sub-band.

• The RF output power (e.i.r.p) at the highest power level "PH" shall be calculated for each of the sub-bands from the Peak to Mean Power Ratio obtained in step 5 and the measured values for Peak Power in each of the sub-bands (see step 1 and step 2). These values (values "A" in dBm) will be used for maximum e.i.r.p. calculations.

- Add the (stated) antenna assembly gain "G" in dBi of the individual antenna element.

- If applicable, add the additional beamforming gain "Y" in dB.

- If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G + Y) shall be used:

For each sub-band, PH (e.i.r.p.) shall be calculated using the formula below.

PH = A + G + Y

• These values for PH shall be compared to the applicable limits contained in in table 2 of clause 4.2.3.2.2 and shall be recorded in the report.

8.3.5 Test Results

NOTE: All the modulation modes are tested, the data of the worst mode are described in the table.

Test Mode	Antenna	Frequency[MHz]	Conducted power [dBm]	Duty Cycle [%]	DC Factor [dBm]	Result [dBm]	Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Verdict
11A	Ant1	5180	14.18	94.21	0.26	14.44	0.50	14.94	23	PASS
11N20SISO	Ant1	5180	14.14	97.55	0.11	14.25	0.50	14.75	23	PASS
11N40SISO	Ant1	5190	14.29	93.71	0.28	14.57	0.50	15.07	23	PASS
11AC20SISO	Ant1	5180	13.94	92.20	0.35	14.29	0.50	14.79	23	PASS
11AC40SISO	Ant1	5190	14.27	84.72	0.72	14.99	0.50	15.49	23	PASS
11AC80SISO	Ant1	5210	14.08	90.96	0.41	14.49	0.50	14.99	23	PASS

8.4 RF OUTPUT POWER AT THE LOWEST POWER LEVEL WITH TPC

8.4.1 Applicable standard

ETSI EN 301 893 Clause 4.2.3

8.4.2 Conformance Limit

RF Output Power <= (17 dBm) mean EIRP for 5250-5350MHz with TPC under both Normal and Extreme test conditions.

RF Output Power <= (24 dBm) mean EIRP for 5470-5725MHz with TPC under both Normal and Extreme test conditions.

8.4.3 Test Configuration

The measurements for RF Output Power shall be performed at normal environmental conditions of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.
Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s) provided.

8.4.4 Test Procedure

Please refer to ETSI EN 301 893 (V2.1.1) clause 5.4.4.2 for the measurement method.

Step 1:

For equipment configured into a continuous transmit mode (x = 1), proceed immediately with step 2.

• The output power of the transmitter shall be coupled to a matched diode detector or equivalent thereof. The output of the diode detector shall be connected to the vertical channel of an oscilloscope.

• The combination of the diode detector and the oscilloscope shall be capable of faithfully reproducing the duty cycle of the transmitter output signal.

• The observed duty cycle of the transmitter (Tx on / (Tx on + Tx off)) shall be noted as x ($0 < x \leq 1$), and recorded in the test report.

Step 2:

• The RF output power shall be determined using a wideband RF power meter with a thermocouple detector or an equivalent thereof and with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be noted as A (in dBm).

• In case of conducted measurements on smart antenna systems operating in a mode with multiple transmit chains active simultaneously, the output power of each transmit chain shall be measured separately to calculate the total power (value A in dBm) for the UUT.

Step 3:

• The RF output power at the highest power level PH (e.i.r.p.) shall be calculated from the above measured power output A (in dBm), the observed duty cycle x, the stated antenna gain G in dBi and if applicable the beamforming gain Y in dB, according to the formula below. This value shall be recorded in the test report. If more than one antenna assembly is intended for this power setting or TPC range, the gain of the antenna assembly with the highest gain shall be used.

$PH = A + G + Y + 10 \times \log(1 / x)$ (dBm). (5)

• This value PH shall be compared to the applicable limit contained in table 2 of clause 4.2.3.2.2.

8.4.5 Test Results

PASS

NOTE: Please refer to the test data of chapter 8.3.

8.5 POWER DENSITY AT THE HIGHEST POWER LEVEL

8.5.1 Applicable standard

ETSI EN 301 893 clause 4.4.2.1

8.5.2 Conformance Limit

For Wide band modulations other than FHSS(e.g. DSSD, OFDM, etc.), the mean e.i.r.p. spectral density<= 10dBm / MHz for 5150-5250MHz

For Wide band modulations other than FHSS(e.g. DSSD, OFDM, etc.), the mean e.i.r.p. spectral density<= 7dBm / MHz without TPC for 5250-5350MHz

For Wide band modulations other than FHSS(e.g. DSSD, OFDM, etc.), the mean e.i.r.p. spectral density<= 10dBm / MHz with TPC for 5250-5350MHz

For Wide band modulations other than FHSS(e.g. DSSD, OFDM, etc.), the mean e.i.r.p. spectral density<= 17dBm / MHz with TPC for 5470-5725MHz

For Wide band modulations other than FHSS(e.g. DSSD, OFDM, etc.), the mean e.i.r.p. spectral density <= 14dBm / MHz without TPC for 5470-5725MHz

For Wide band modulations other than FHSS(e.g. DSSD, OFDM, etc.), the mean e.i.r.p. spectral density <= 10dBm / MHz with TPC slaved devices without Radar interference detection function for 5470-5725MHz

For Wide band modulations other than FHSS(e.g. DSSD, OFDM, etc.), the mean e.i.r.p. spectral density <= 7dBm / MHz without TPC slaved devices without Radar interference detection function for 5470-5725MHz

8.5.3 Test Configuration

The measurements for Power Density shall be performed at both normal environmental conditions of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.
Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s)

8.5.4 Test Procedure

Please refer to ETSI EN 301 893 (V2.1.1) clause 5.4.4.2.1.3 for the measurement method.

- Option 1: For equipment with continuous transmission capability or for equipment operating (or with the capability to operate) with a constant duty cycle (e.g. Frame Based equipment)

This option is for equipment that can be configured to operate in a continuous transmit mode or with a constant duty cycle (x).

Step 1:

• Connect the UUT to the spectrum analyser and use the following settings:

- Centre Frequency: The centre frequency of the channel under test

- RBW: 1 MHz

- VBW: 3 MHz

- Frequency Span: 2 × Nominal Bandwidth (e.g. 40 MHz for a 20 MHz channel)

- Detector Mode: Peak

- Trace Mode: Max Hold

Step 2:

• When the trace is complete, find the peak value of the power envelope and record the frequency.

Step 3:

• Make the following changes to the settings of the spectrum analyser:

- Centre Frequency: Equal to the frequency recorded in step 2

- Frequency Span: 3 MHz

- RBW: 1 MHz

- VBW: 3 MHz

- Sweep Time: 1 minute

- Detector Mode: RMS

- Trace Mode: Max Hold

Step 4:

• When the trace is complete, the trace shall be captured using the "Hold" or "View" option on the spectrum analyser.

• Find the peak value of the trace and place the analyser marker on this peak. This level is recorded as the highest mean power (power density) D in a 1 MHz band.

• Alternatively, where a spectrum analyser is equipped with a function to measure spectral power density, this function may be used to display the power density D in dBm/MHz.

• In case of conducted measurements on smart antenna systems operating in a mode with multiple transmit chains active simultaneously, the power density of each transmit chain shall be measured separately to calculate the total power density (value "D" in dBm/MHz) for the UUT.

Step 5:

• The maximum spectral power density e.i.r.p. is calculated from the above measured power density (D), the observed duty cycle x (see clause 5.4.4.2.1.1.2, step 1), the applicable antenna assembly gain "G" in dBi and if applicable the beamforming gain "Y" in dB, according to the formula below. This value shall be recorded in the test report. If more than one antenna assembly is intended for this power setting, the gain of the antenna assembly with the highest gain shall be used.

PD = D + G + Y + 10 log (1/x).

- Option 2: For equipment without continuous transmission capability and without the capability to transmit with a constant duty cycle .This method can be used if the equipment has non-continuous transmissions and cannot be configured to transmit continuously or with a constant duty cycle.

For devices having simultaneous transmissions in both sub-bands, the Power Density in each of the sub-bands shall be measured separately and compared with the applicable limits contained in table 1 of clause 4.4.2.

The test procedure shall be as follows:

Step 1:

• Connect the UUT to the spectrum analyser and use the following settings:

- Start Frequency: lower band edge of applicable sub-band (e.g. 5 150 MHz or 5 470 MHz)

- Stop Frequency: upper band edge of applicable sub-band (e.g. 5 350 MHz or 5 725 MHz)

- RBW: 10 kHz

- VBW: 30 kHz

- Sweep Points: > 20 000 (for 5 150 MHz to 5 350 MHz) > 25 500 (for 5 470 MHz to 5 725 MHz)

NOTE: For spectrum analysers not supporting this number of sweep points, the frequency band may be segmented.

Detector: RMS

Trace Mode: Max Hold

Sweep time: Auto

• For non-continuous signals, wait for the trace to be completed. Save the (trace) data set to a file.

Step 2:

• For conducted measurements on smart antenna systems using either operating mode 2 or 3 (see clause 5.1.4.2), repeat the measurement for each of the transmit ports. For each frequency point, add up the amplitude (power) values for the different transmit chains and use this as the new data set.

Step 3:

• Add up the values for amplitude (power) for all the samples in the file.

$$P_{Sum} = \sum_{n=1}^{k} P_{sample}(n)$$

with 'k' being the total number of samples and 'n' the actual sample number

Step 4:

• Normalize the individual values for amplitude so that the sum is equal to the RF Output Power (e.i.r.p.) (PH) measured in clause 5.4.4.2.1.1. for this sub-band.

$$C_{Corr} = P_{Sum} - P_{H\,e.i.r.p}$$

$$P_{Samplecorr}(n) - P_{Sample}(n) - C_{Corr}$$

with 'n' being the actual sample number

Step 5:

• Starting from the first sample in the file (lowest frequency), add up the power of the following samples representing a 1 MHz segment and record the results for power and position (i.e. sample #1 to #100). This is the Power Density (e.i.r.p.) for the first 1 MHz segment which shall be saved.

Step 6:

• Shift the start point of the samples added up in step 5 by 1 sample and repeat the procedure in step 5 (i.e. sample #2 to #101).

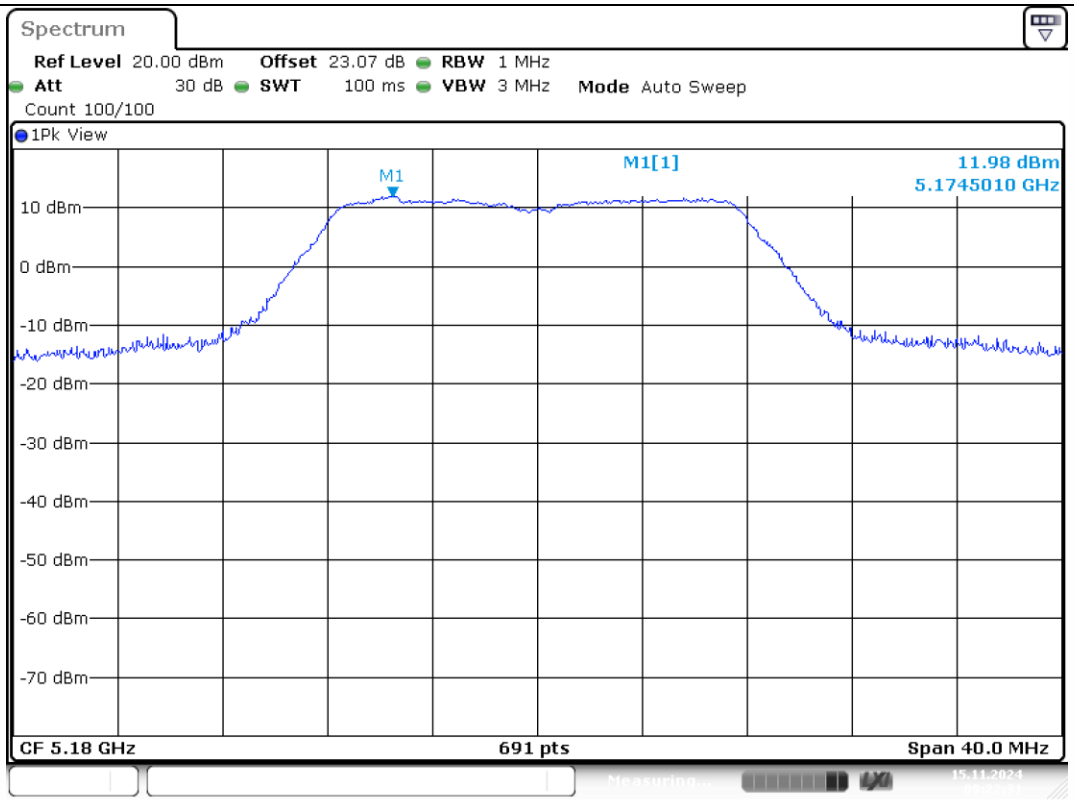
Step 7:

• Repeat step 6 until the end of the data set and save the radiated power density values for each of the 1 MHz segments.

• From all the saved results, the highest value is the maximum Power Density (e.i.r.p.) for the UUT. This value, which shall comply with the limit contained in table 2 of clause 4.2.3.2.2, shall be recorded in the test report.

8.5.5 Test Results

TestMode	Antenna	Channel	PD [dBm/MHz]	DC Factor [dB]	Gain [dBi]	EIRP PSD [dBm/MHz]	Limit [dBm]	Verdict
11A	Ant1	5180	1.86	0.15	0.50	2.51	10	PASS
11N20SISO	Ant1	5180	1.43	0.26	0.50	2.19	10	PASS
11N40SISO	Ant1	5190	-1.95	0.55	0.50	-0.90	10	PASS
11AC20SISO	Ant1	5180	1.29	0.20	0.50	1.99	10	PASS
11AC40SISO	Ant1	5190	-2.52	0.51	0.50	-1.51	10	PASS
11AC80SISO	Ant1	5210	-3.76	1.45	0.50	-1.81	10	PASS



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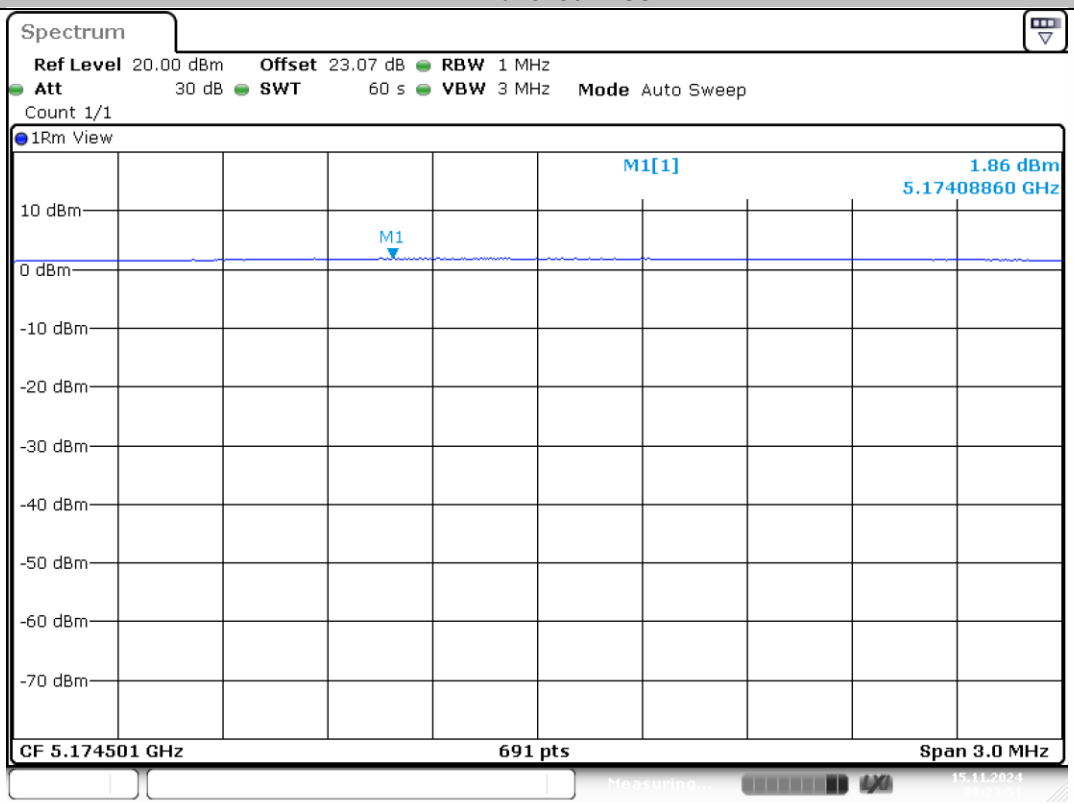

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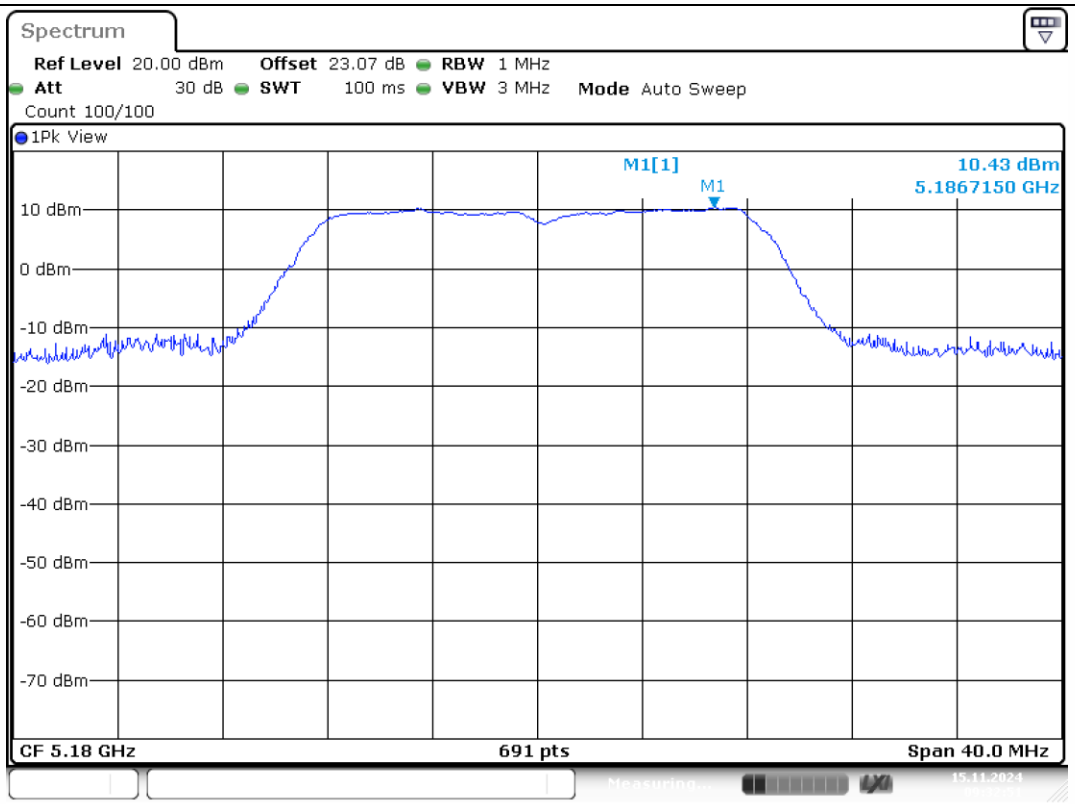

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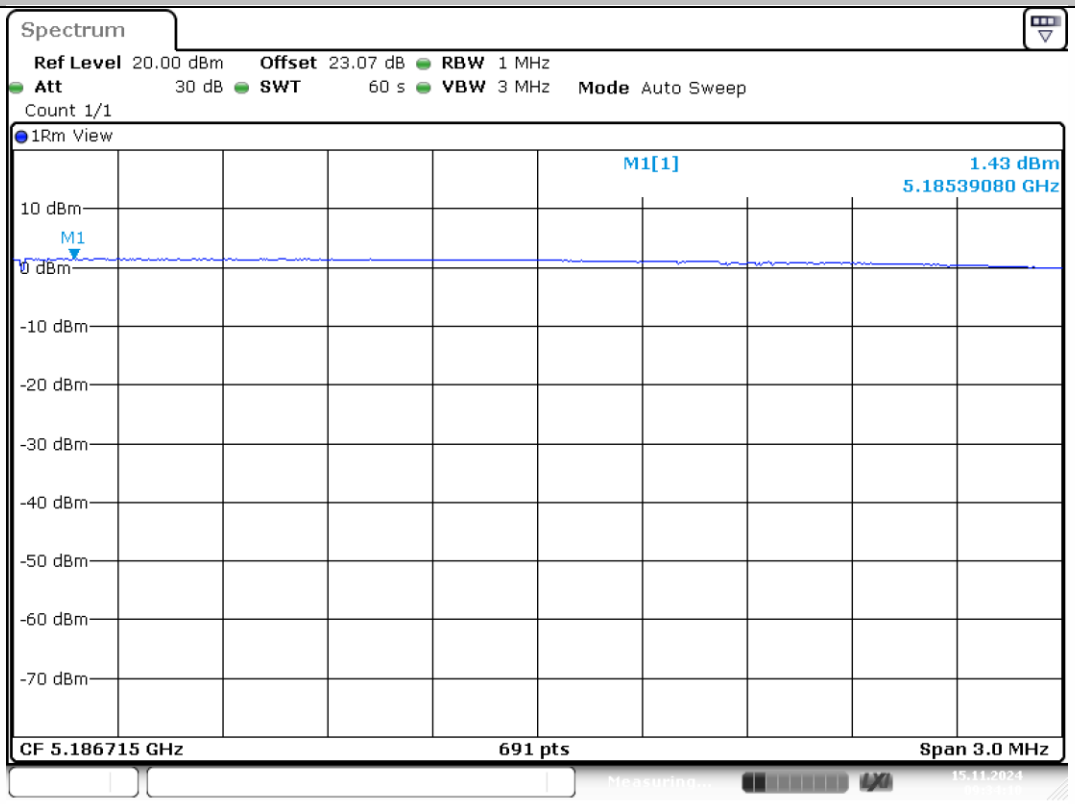

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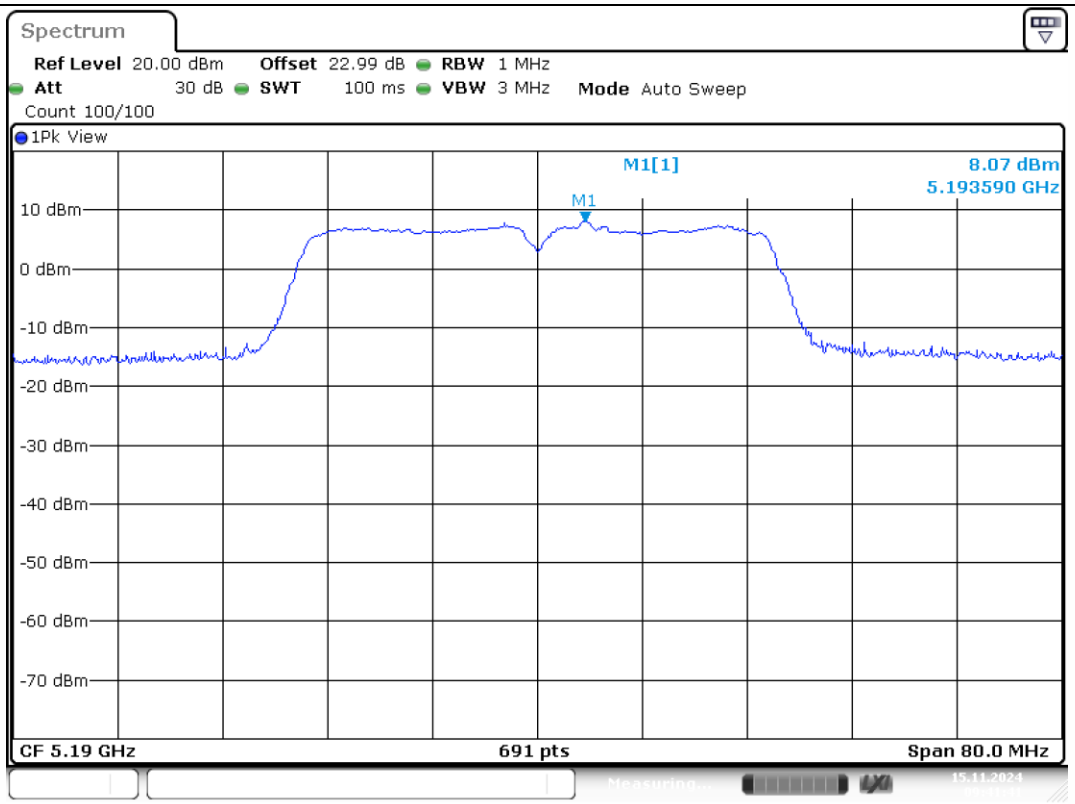

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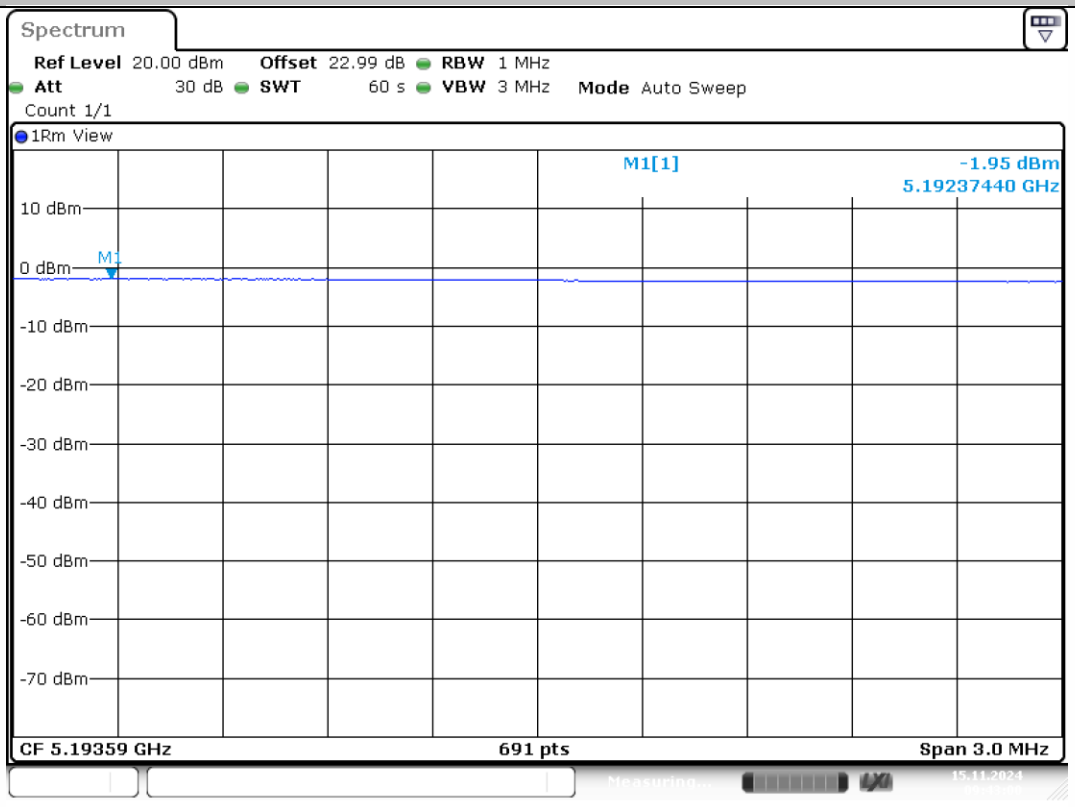

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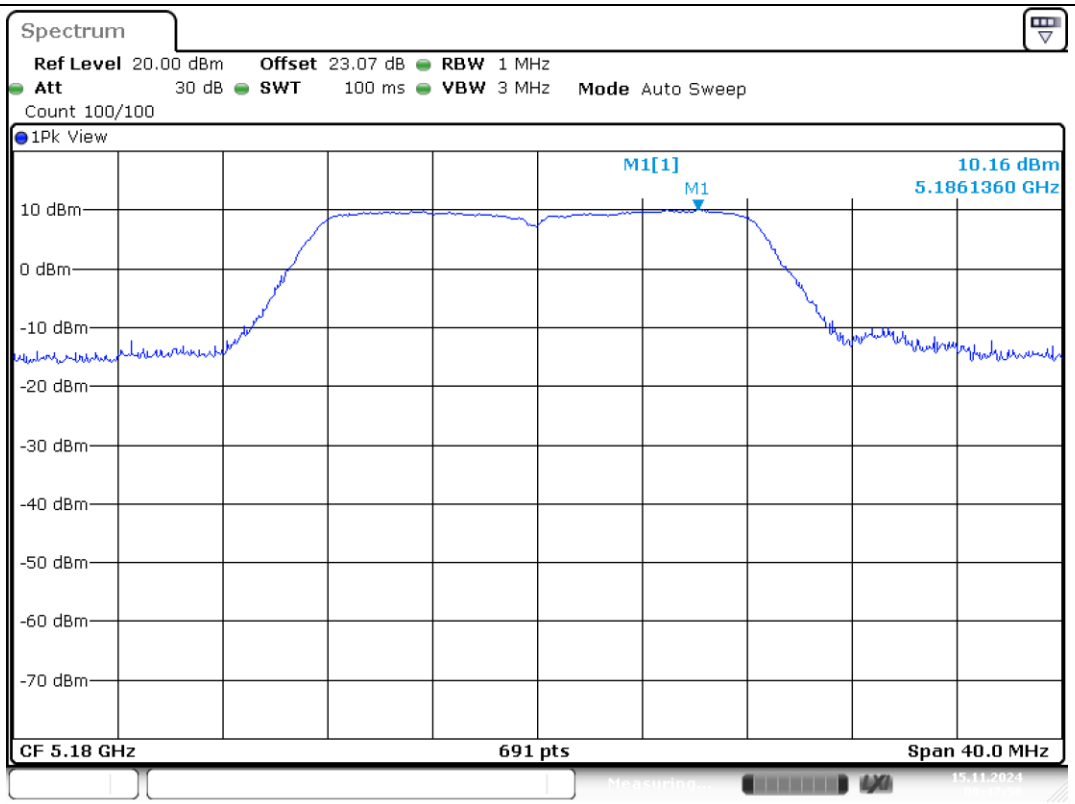

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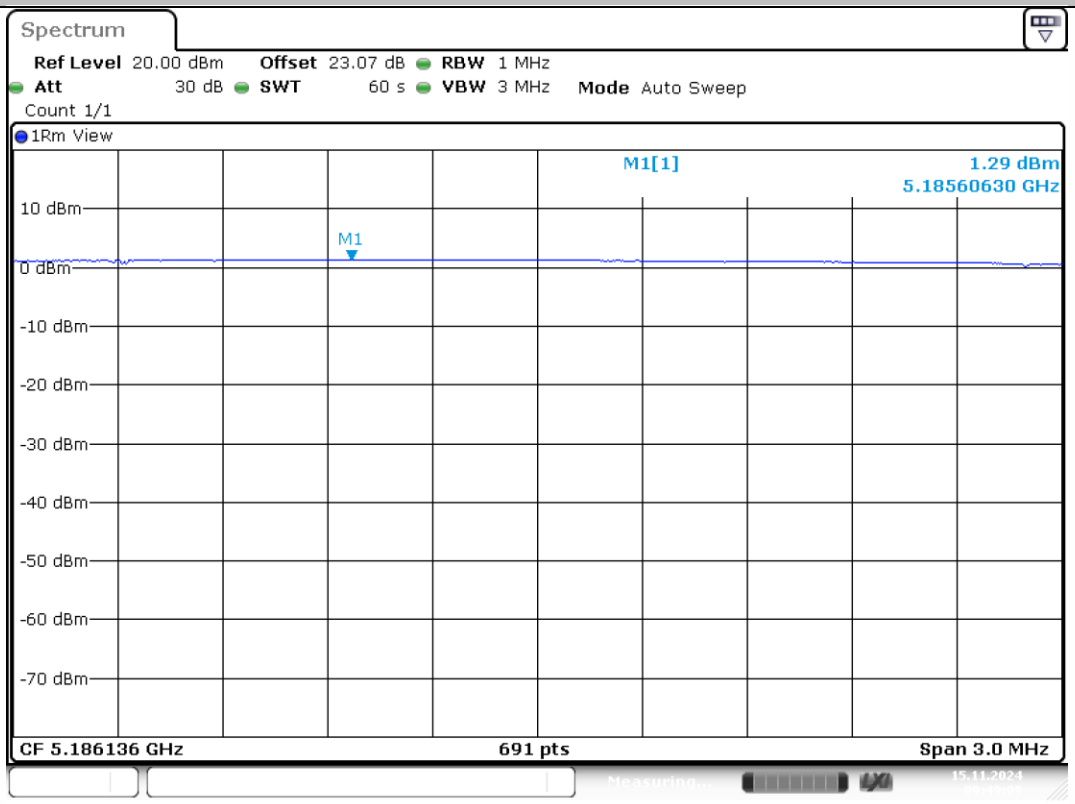

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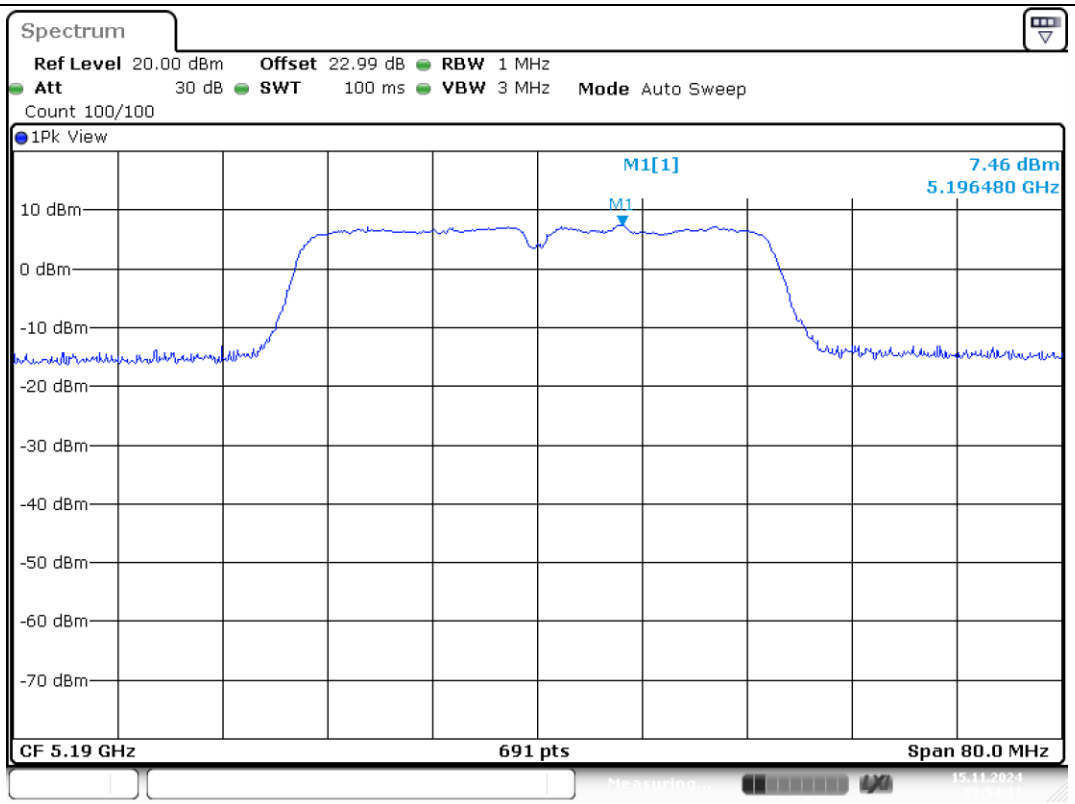

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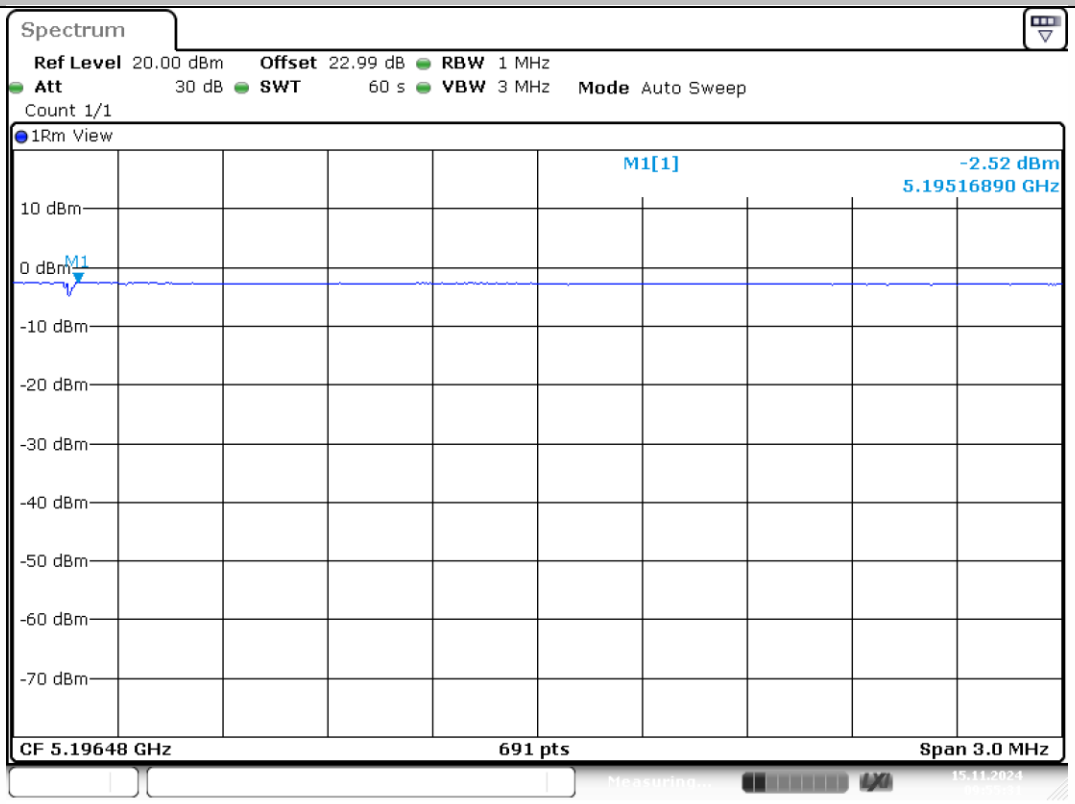

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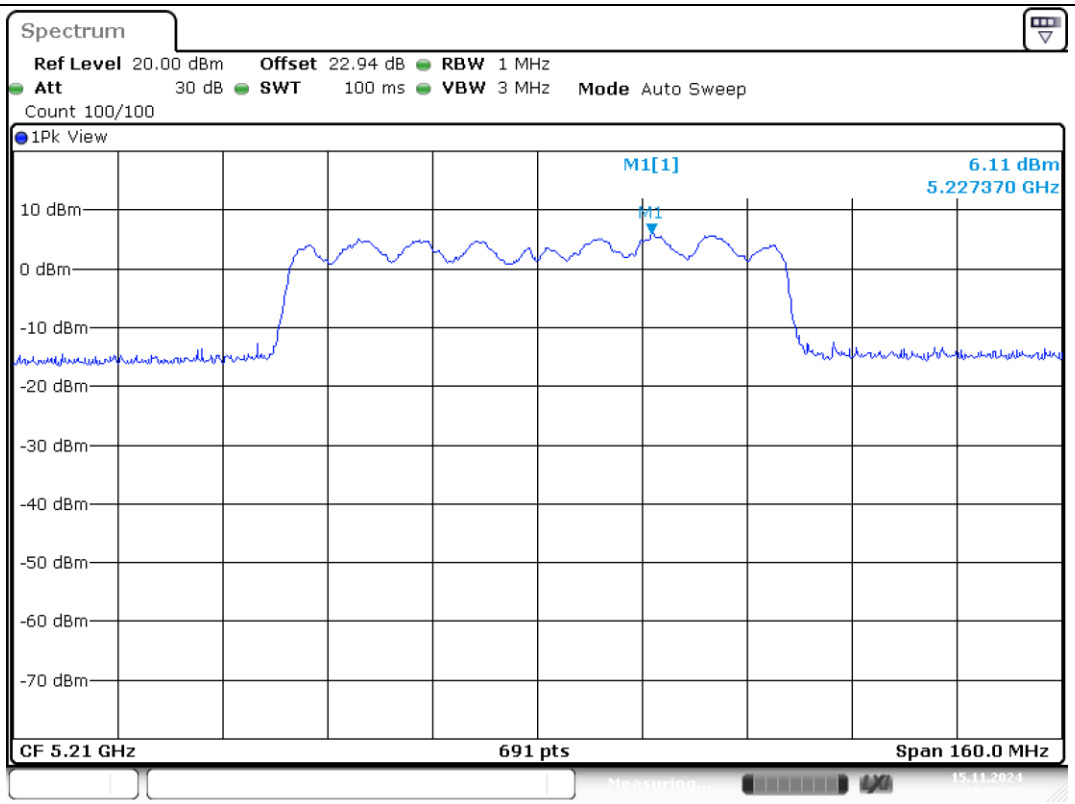

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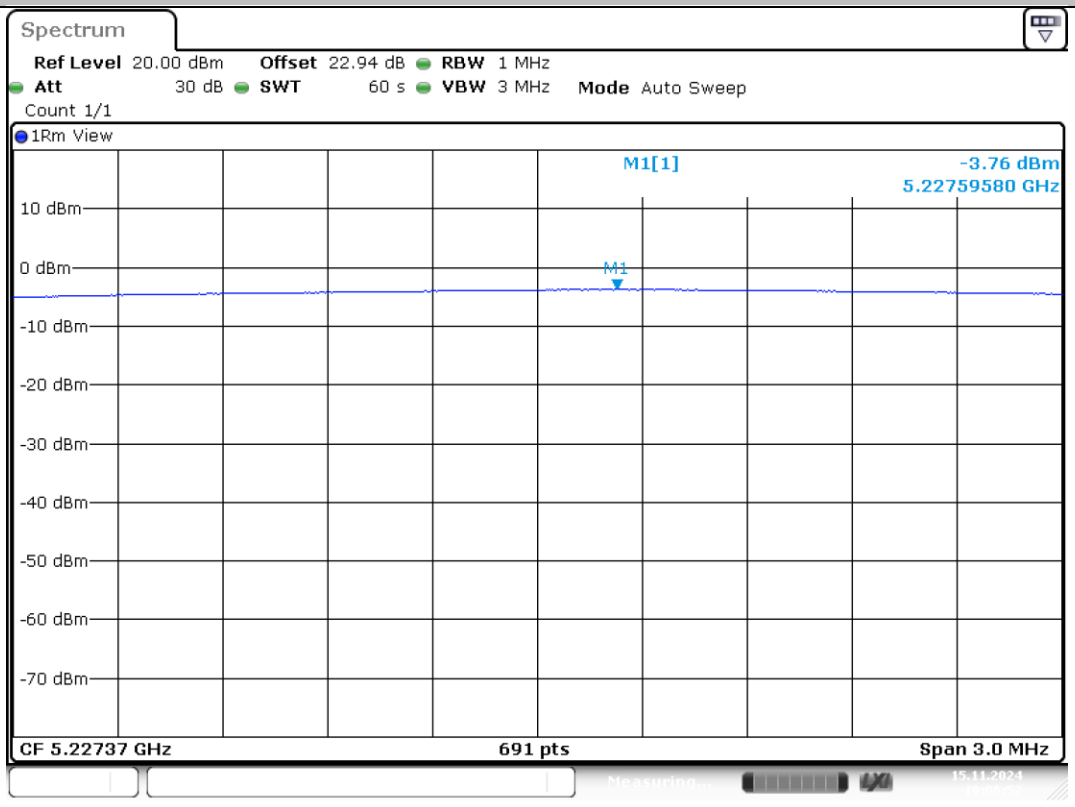

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8.6 TRANSMITTER UNWANTED EMISSIONS OUTSIDE THE 5GHZ RLAN BANDS

8.6.1 Applicable standard

ETSI EN 301 893 clause 4.2.4.1

8.6.2 Conformance Limit

The level of unwanted emission shall not exceed the limits given in following table.

Frequency range	Maximum power, ERP	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 5,15 GHz	-30 dBm	1 MHz
5,35 GHz to 5,47 GHz	-30 dBm	1 MHz
5,725 GHz to 26 GHz	-30 dBm	1 MHz

8.6.3 Test Configuration

The measurements for transmitter unwanted emissions shall be performed at normal environmental conditions of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.6.4 Test Procedure

2. Please refer to ETSI EN 301 893 (V2.1.1) 5.4.5.1 & 5.4.5.2 for the measurement methods.

The UUT shall be connected to a spectrum analyser capable of RF power measurements.

If possible, the UUT shall be set to continuous transmit (duty cycle = 1) for the duration of this test.

If continuous transmit is not possible, the UUT should be configured to operate at its maximum duty cycle.

- Pre-scan

The test procedure below shall be used to identify potential unwanted emissions of the UUT.

Step 1:

• The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in 4.2.4.1.2, table 4.

Step 2:

• The unwanted emissions over the range 30 MHz to 1 000 MHz shall be identified.

• Spectrum analyser settings:

- Resolution bandwidth: 100 kHz

- Video bandwidth: 300 kHz

- Detector mode: Peak

- Trace Mode: Max Hold

- Sweep Points: ≥ 9 970

- Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 100 kHz frequency step, the measurement time is greater than two transmissions of the UUT.

NOTE 1: E.g. for non continuous transmissions, if the UUT is using a test sequence as described in clause 5.1.2.1 (transmitter on + off time of 2 ms), then the sweep time has to be greater than 4 ms per 100 kHz.

• Allow the trace to stabilize. Any emissions identified that are higher than the "applicable limit - 6 dB", shall be individually measured using the procedure in4.2.4.1.2, table 4 and compared to the limits given in

clause 4.2.4.1.2, table 4.

Step 3:

• The unwanted emissions over the range 1 GHz to 26 GHz shall be identified.

• Spectrum analyser settings:

- Resolution bandwidth: 1 MHz

- Video bandwidth: 3 MHz

- Detector mode: Peak

- Trace Mode: Max Hold

- Sweep points: 25 000

NOTE 2: For spectrum analysers not supporting this number of sweep points, the frequency band may be

segmented. - Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 1 MHz frequency step, the measurement time is greater than two transmissions of the UUT.

NOTE 3: E.g. for non continuous transmissions, if the UUT is using a test sequence as described in clause 5.1.2.1 (transmitter on + off time of 2 ms), then the sweep time has to be greater than 4 ms per 1 MHz.

• Allow the trace to stabilize. Any emissions identified that are higher than the "applicable limit - 6 dB", shall be individually measured using the procedure in 4.2.4.1.2, table 4 and compared to the limits given in clause 4.2.4.1.2, table 4.

● Measurement of the emissions identified during the pre-scan

The limits for unwanted emissions in clause 4.2.4.1 refer to average power levels.

The steps below shall be used to accurately measure the individual unwanted emissions identified during the pre-scan measurements above.

The signal to noise ratio shall be sufficient to allow an accurate measurement.

Continuous transmit signals:

For continuous transmit signals, a simple measurement using the RMS detector of the spectrum analyser is permitted.

The measured values shall be recorded and compared with the limits in clause 4.2.4.1.2, table 4.

Non-continuous transmit signals:

For non-continuous transmit signals, the measurement shall be made only over the "on" part of the burst.

Step 1:

• The level of the emissions shall be measured in the time domain, using the following spectrum analyser

settings:

- Centre Frequency: Frequency of emission identified during the pre-scan

- RBW: 100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)

- VBW: 300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)

- Frequency Span: 0 Hz

- Sweep mode: Single Sweep

- Sweep Time: Suitable to capture one transmission burst. Additional measurements may be

needed to identify the length of the transmission burst. In case of continuous signals, the Sweep Time shall be set to 30 ms

- Sweep points: Sweeptime [µs] / 1 µs with a maximum of 30 000

- Trigger: Video (burst signals) or Manual (continuous signals)

- Detector: RMS

- Trace Mode: Clear/Write

Step 2:

Adjust the trigger level to select the transmissions with the highest power level.

Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function. If the spurious emission to be measured is a continuous signal, the measurement window shall be set to match the start and stop times of the sweep.

Select RMS power to be measured within the selected window and note the result which is the RMS power of this particular spurious emission. Compare this value with the applicable limit provided by clause 4.2.4.1.2, table 4.

Repeat this procedure for every emission identified during the pre-scan. The values and corresponding frequencies shall be recorded.

In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the measurements shall be repeated for each of the active transmit chains. Comparison with the applicable limits shall be done using either of the options given below:

• Option 1: the results for each of the transmit chains for the corresponding 1 MHz segments shall be added and

compared with the limits provided by table 4 in clause 4.2.4.1.2.

• Option 2: the results for each of the transmit chains shall be individually compared with the limits provided by table 4 in clause 4.2.4.1.2 after these limits have been reduced by 10 × log10 (Tch) (number of active transmit chains).

8.6.5 Test Results

NOTE: All the modulation modes are tested, the data of the worst mode are described in the table.

Emission in the Spurious Domain below 1GHz:

Operation Mode:	☒802.11a	
Operation frequency:	☒5180MHz	Temperature: 25°C
Humidity:	60 % RH	Tested by: CZF

Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Margin (dB)	Verdict
55.225	H	-73.36	-54.00	19.36	PASS
225.3971	H	-73.82	-54.00	19.82	PASS
420.9882	H	-67.98	-36.00	31.98	PASS
648.0136	H	-63.63	-54.00	9.63	PASS
760.3621	H	-69.14	-54.00	15.14	PASS
981.3723	H	-67.24	-36.00	31.24	PASS
53.8668	V	-62.81	-54.00	8.81	PASS
339.6859	V	-73.28	-36.00	37.28	PASS
423.1226	V	-59.84	-36.00	23.84	PASS
648.0136	V	-63.28	-54.00	9.28	PASS
720.196	V	-66.72	-54.00	12.72	PASS
991.2683	V	-67.53	-36.00	31.53	PASS

Emission in the Spurious Domain above 1GHz:

Operation Mode:	☒802.11a	
Operation frequency:	☒5180MHz	Temperature: 25°C
Humidity:	60 % RH	Tested by: CZF

Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Margin (dB)	Verdict
3790.790	H	-50.10	-30.00	20.10	PASS
6479.479	H	-47.33	-30.00	17.33	PASS
9372.372	H	-39.42	-30.00	9.42	PASS
12061.06	H	-38.70	-30.00	8.70	PASS
14273.27	H	-38.22	-30.00	8.22	PASS
17914.91	H	-37.39	-30.00	7.39	PASS
3586.586	V	-50.20	-30.00	20.20	PASS
6479.479	V	-47.21	-30.00	17.21	PASS
8691.691	V	-39.81	-30.00	9.81	PASS
11567.56	V	-39.31	-30.00	9.31	PASS
15039.03	V	-38.92	-30.00	8.92	PASS
17081.08	V	-38.68	-30.00	8.68	PASS

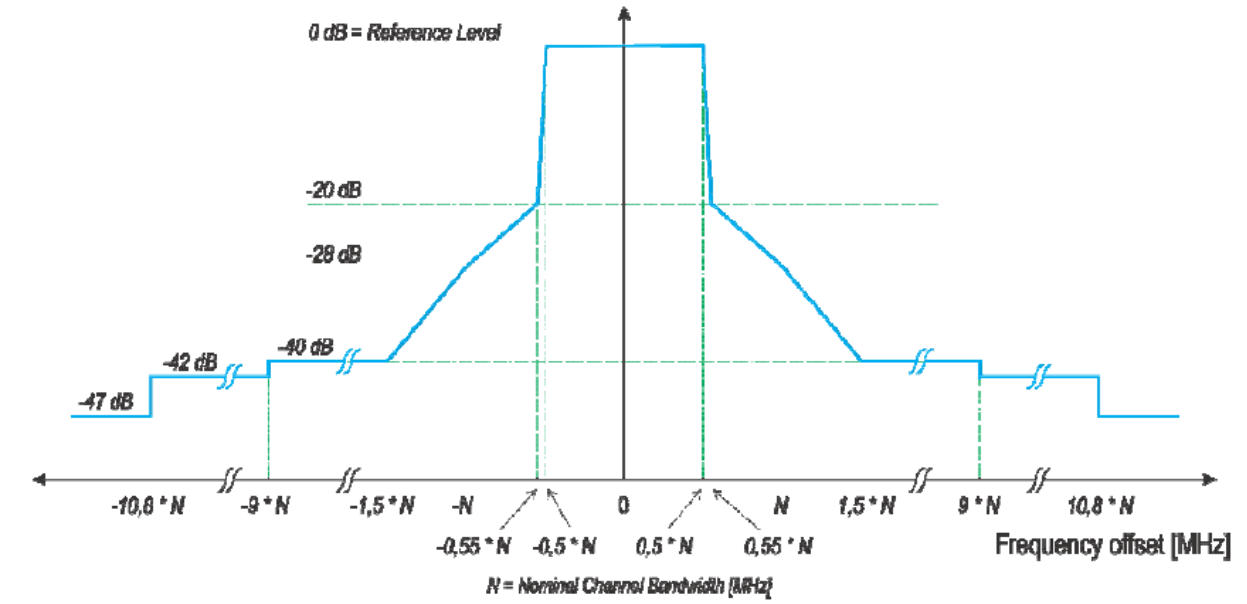
8.7 TRANSMITTR UNWANTED EMISSIONS WITHIN THE 5GHZ RLAN BANDS

8.7.1 Applicable standard

ETSI EN 301 893 clause 4.2.4.2

8.7.2 Conformance Limit

The average level of the transmitted spectrum within the 5GHz RLAN bands shall not exceed the limits of the mask given in below figure.



8.7.3 Test Configuration

The measurements for transmitter unwanted emissions shall be performed at normal environmental conditions of the operating temperature range.

Radiated measurements shall be used for equipment.

Conducted measurements shall be used for equipment.

8.7.4 Test Procedure

Please refer to ETSI EN 301 893 Clause 5.4.6.1 & 5.4.6.2 for the measurement methods.

● Option 1: For equipment with continuous transmission capability

The UUT shall be configured for continuous transmit mode (duty cycle equal to 100 %). If this is not possible, then option 2 shall be used.

Step 1: Determination of the reference average power level.

• Spectrum analyser settings:

- Resolution bandwidth: 1 MHz

- Video bandwidth: 30 kHz

- Detector mode: Peak

- Trace mode: Video Average

- Sweep Time: Coupled

- Centre Frequency: Centre frequency of the channel being tested

- Span: 2 times the Nominal Channel Bandwidth

• Use the marker to find the highest average power level of the power envelope of the UUT. This level shall be used as the reference level for the relative measurements.

Step 2: Determination of the relative average power levels.

• Adjust the frequency range of the spectrum analyser to allow the measurement to be performed within the sub-bands 5 150 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz. No other parameter of the spectrum analyser should be changed.

• Compare the relative power envelope of the UUT with the limits defined in clause 4.2.4.2.2..

● Option 2: For equipment without continuous transmission capability

This method shall be used if the UUT is not capable of operating in a continuous transmit mode (duty cycle less than 100 %). In addition, this option can also be used as an alternative to option 1 for systems operating in a continuous transmit mode.

Step 1: Determination of the reference average power level.

• Spectrum analyser settings:

- Resolution bandwidth: 1 MHz

- Video bandwidth: 30 kHz

- Detector mode: RMS

- Trace Mode: Max Hold

- Sweep time: ≥ 1 minute

- Centre Frequency: Centre frequency of the channel being tested

- Span: 2 times the Nominal Channel Bandwidth

• Use the marker to find the highest average power level of the power envelope of the UUT. This level shall be used as the reference level for the relative measurements.

Step 2: Determination of the relative average power levels.

Adjust the frequency range of the spectrum analyser to allow the measurement to be performed within the sub-bands 5 150 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz. No other parameter of the spectrum analyser should be changed.

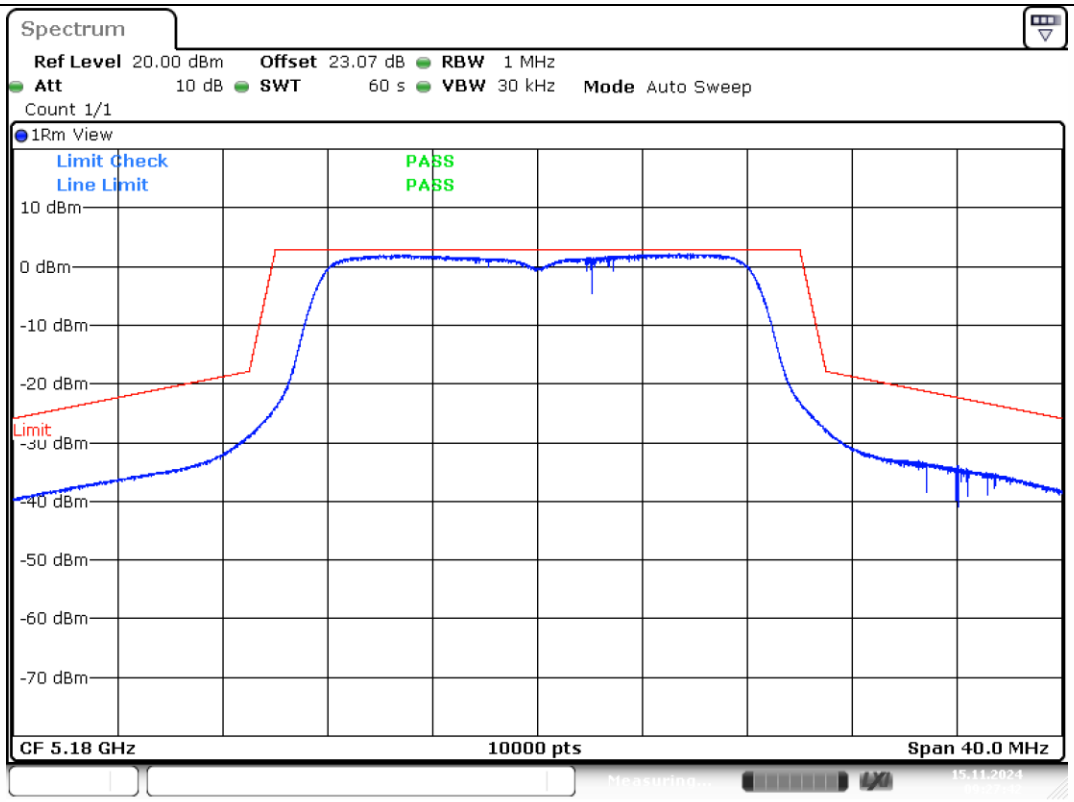
Compare the relative power envelope of the UUT with the limits defined in clause 4.2.4.2.2.

8.7.5 Test Results

PASS

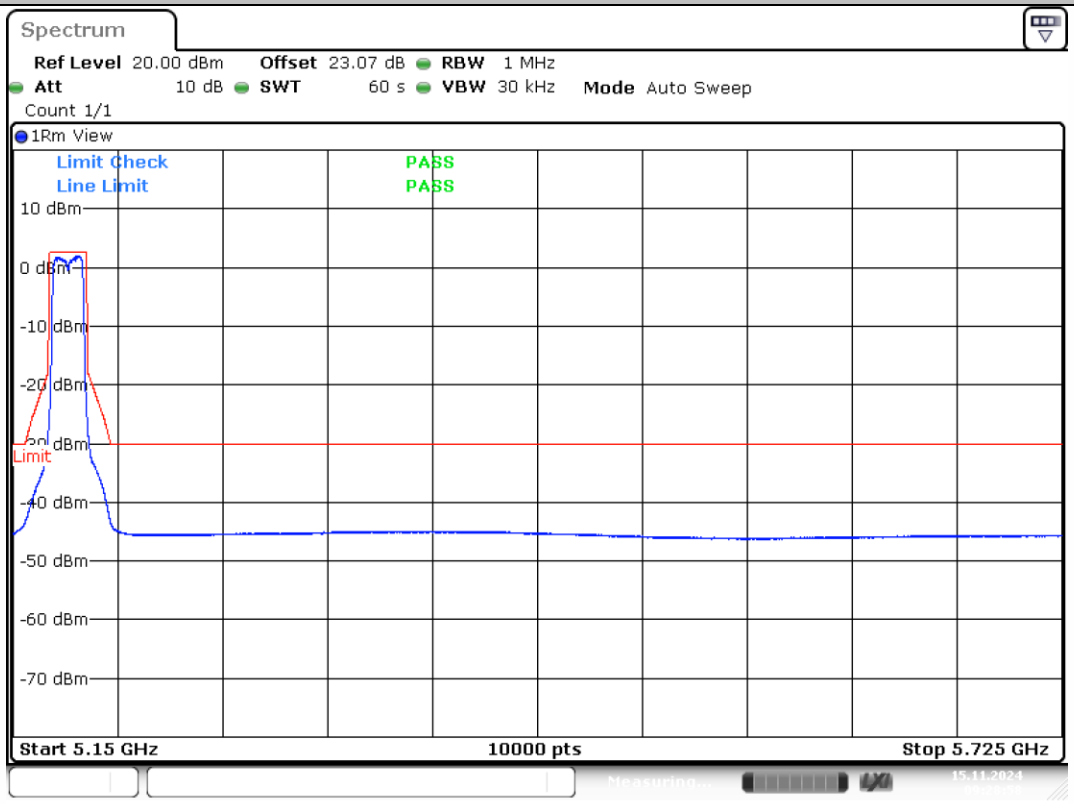
NOTE: All the modulation modes are tested, the data of the worst mode are described in the table.

TestMode	Antenna	Frequency[MHz]	Result [dBm]	Limit[dBm]	Verdict
11A	Ant1	5180	See test graph	See test graph	PASS
11N20SISO	Ant1	5180	See test graph	See test graph	PASS
11N40SISO	Ant1	5190	See test graph	See test graph	PASS
11AC20SISO	Ant1	5180	See test graph	See test graph	PASS
11AC40SISO	Ant1	5190	See test graph	See test graph	PASS
11AC80SISO	Ant1	5210	See test graph	See test graph	PASS



Date: 15.NOV.2024 09:27:42

NTNV-11A-Ant1-5180-PASS



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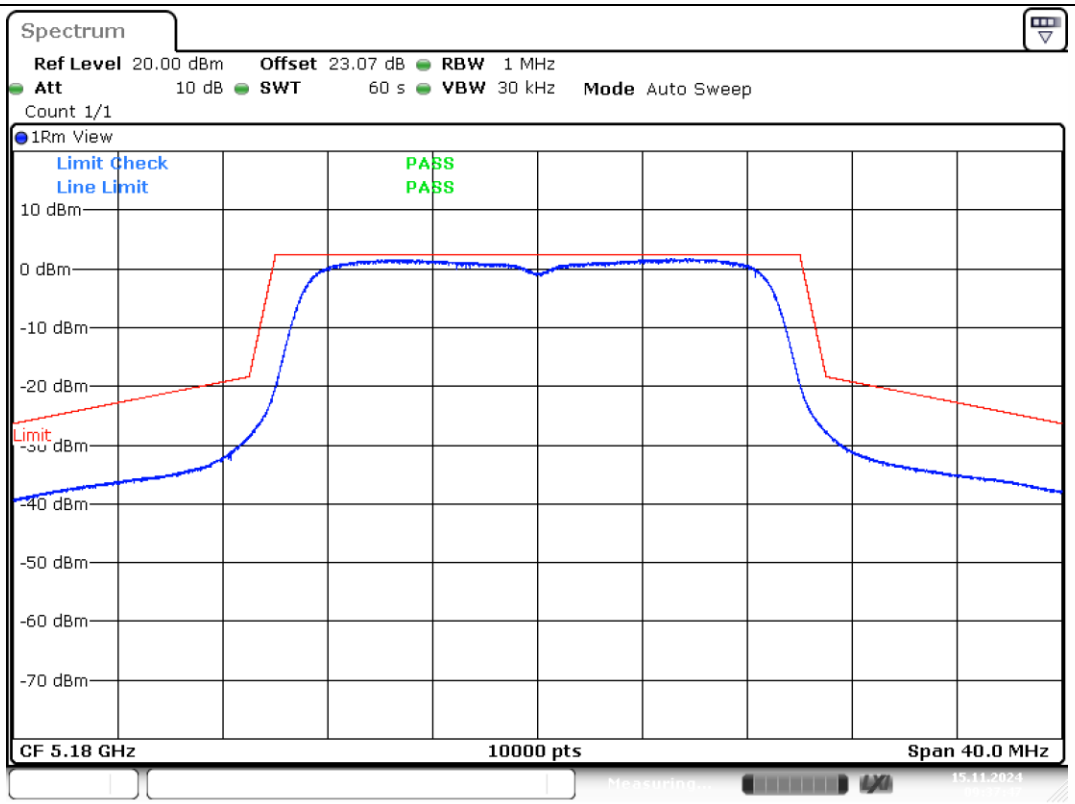

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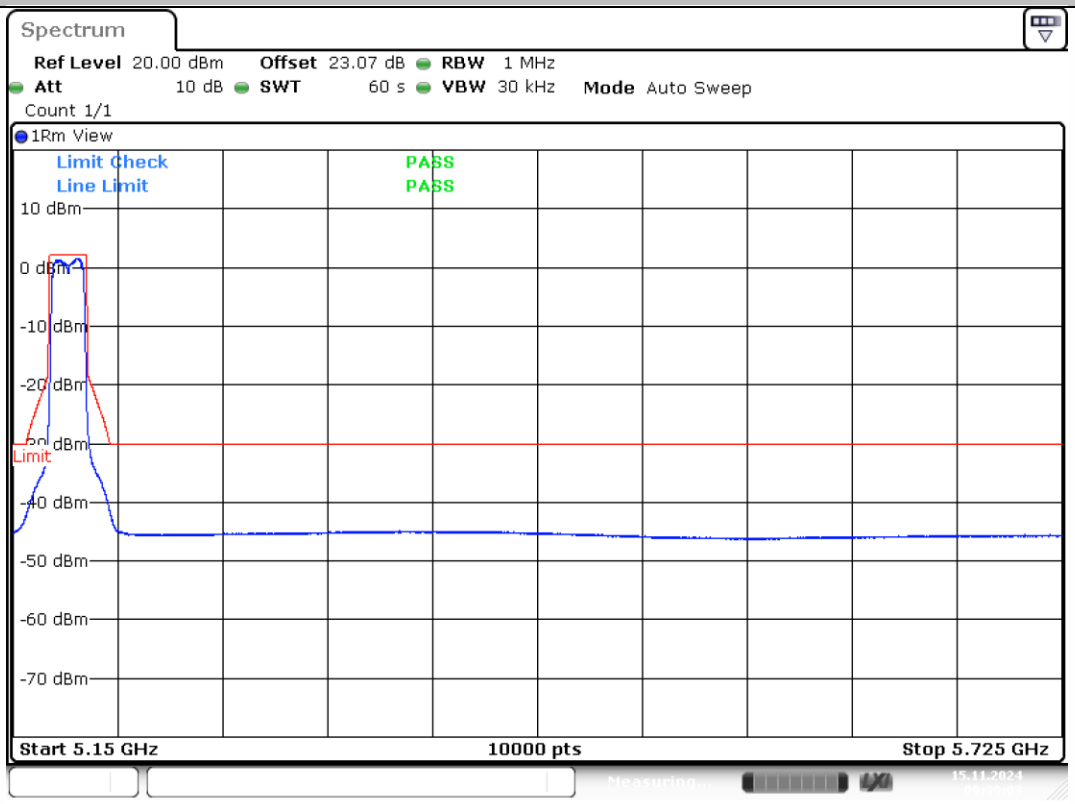
NTNV-11N20SISO-Ant1-5180-PASS



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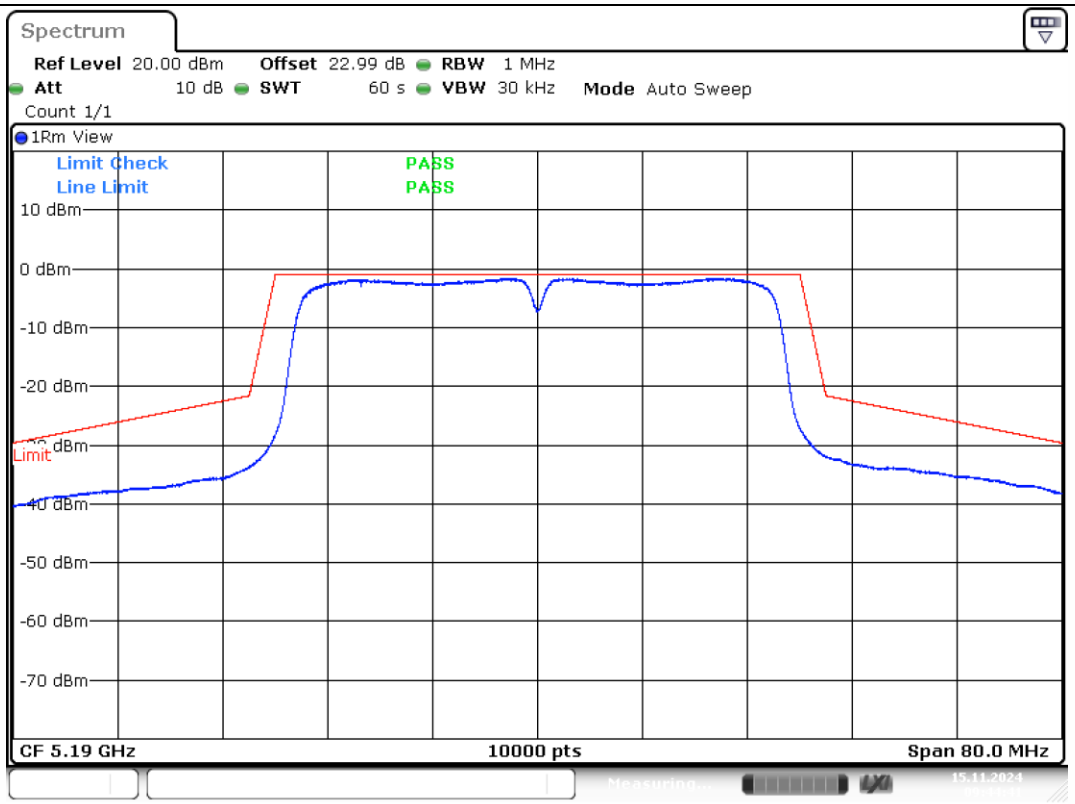

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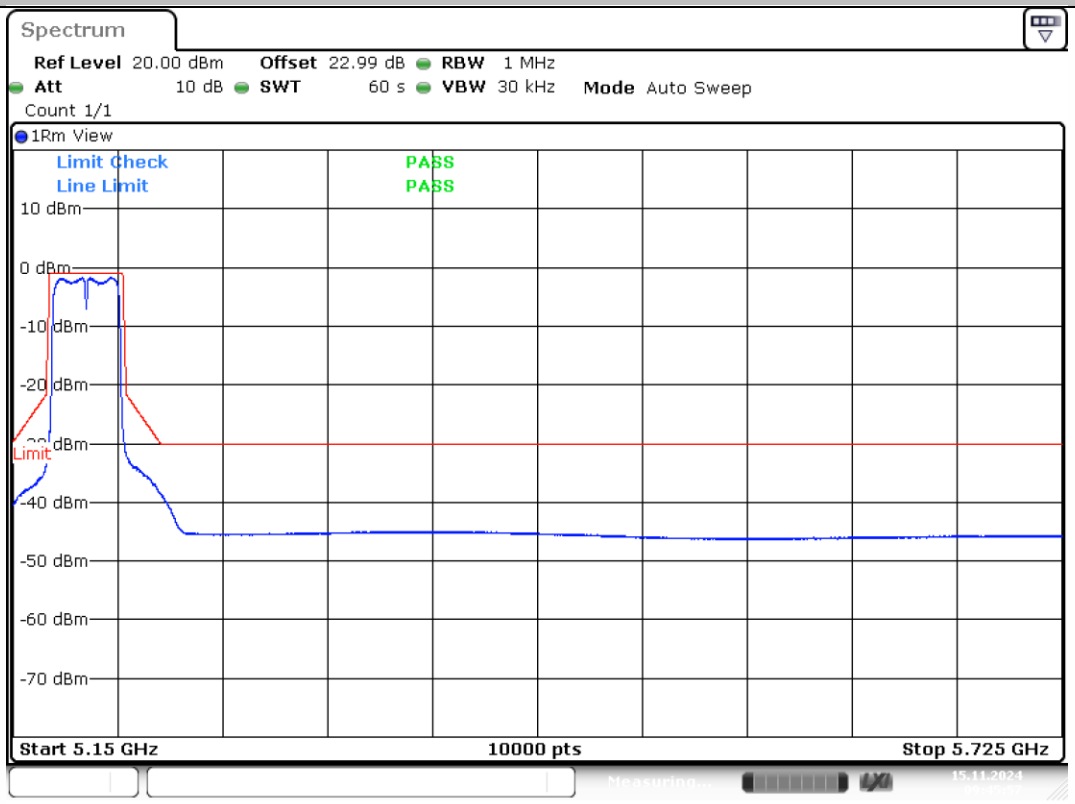

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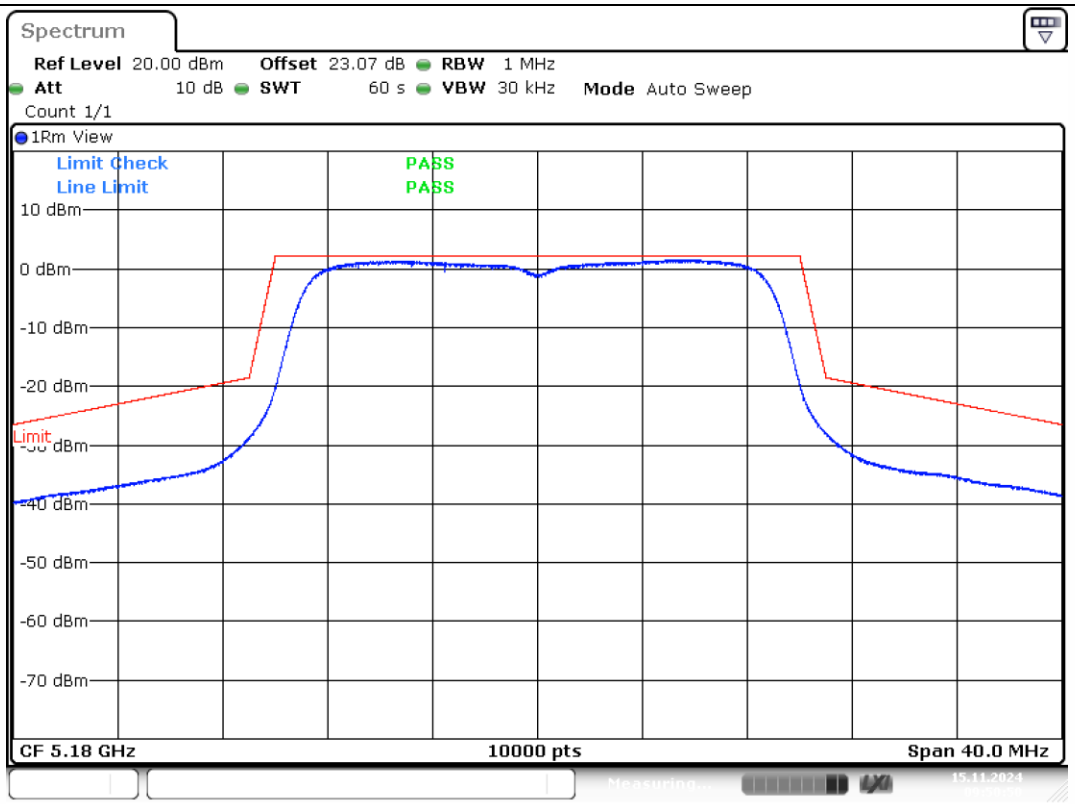

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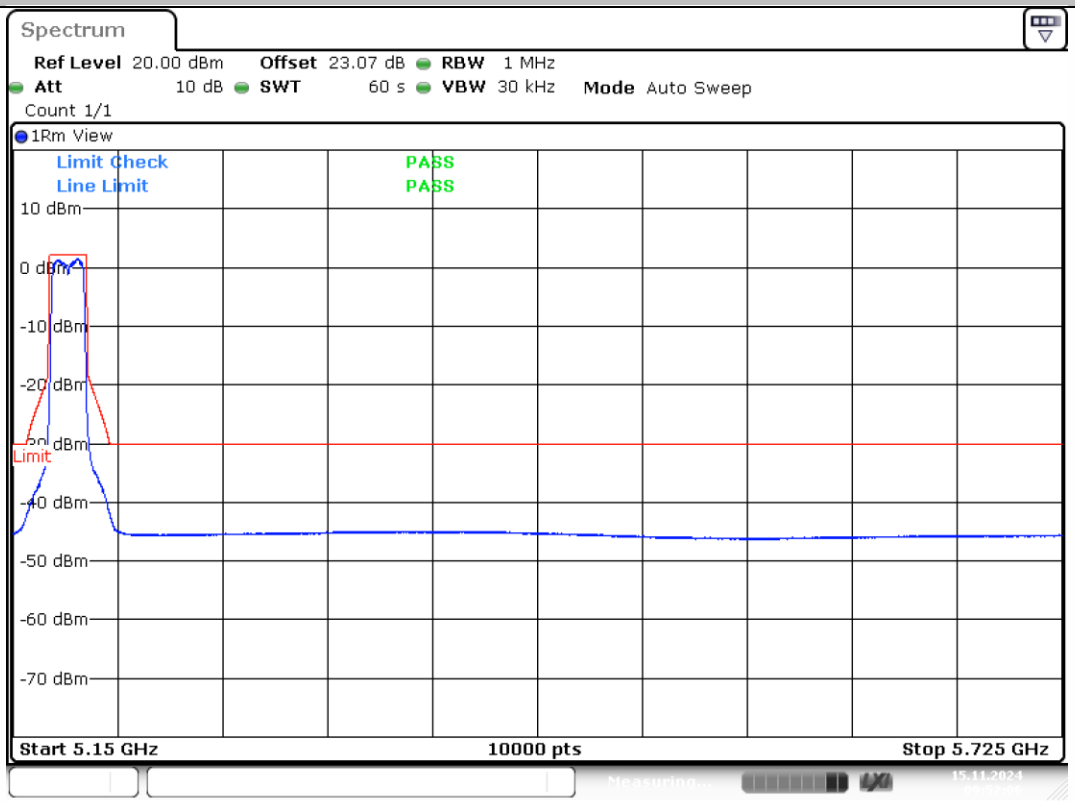

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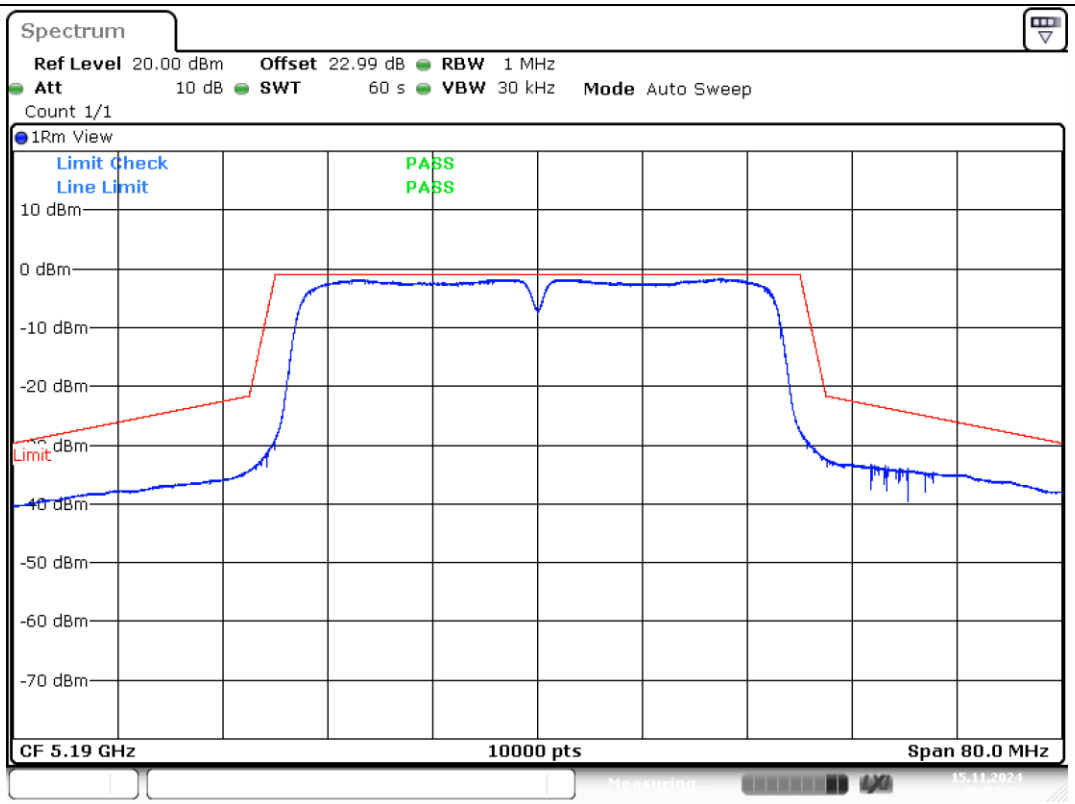

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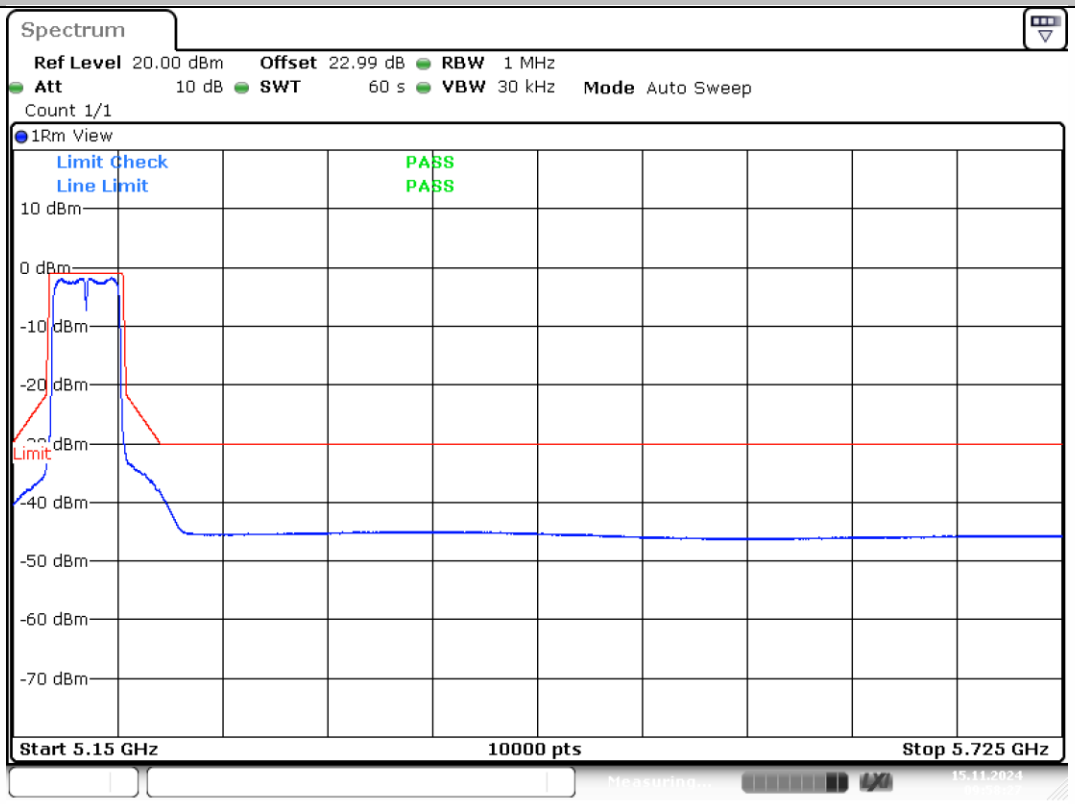

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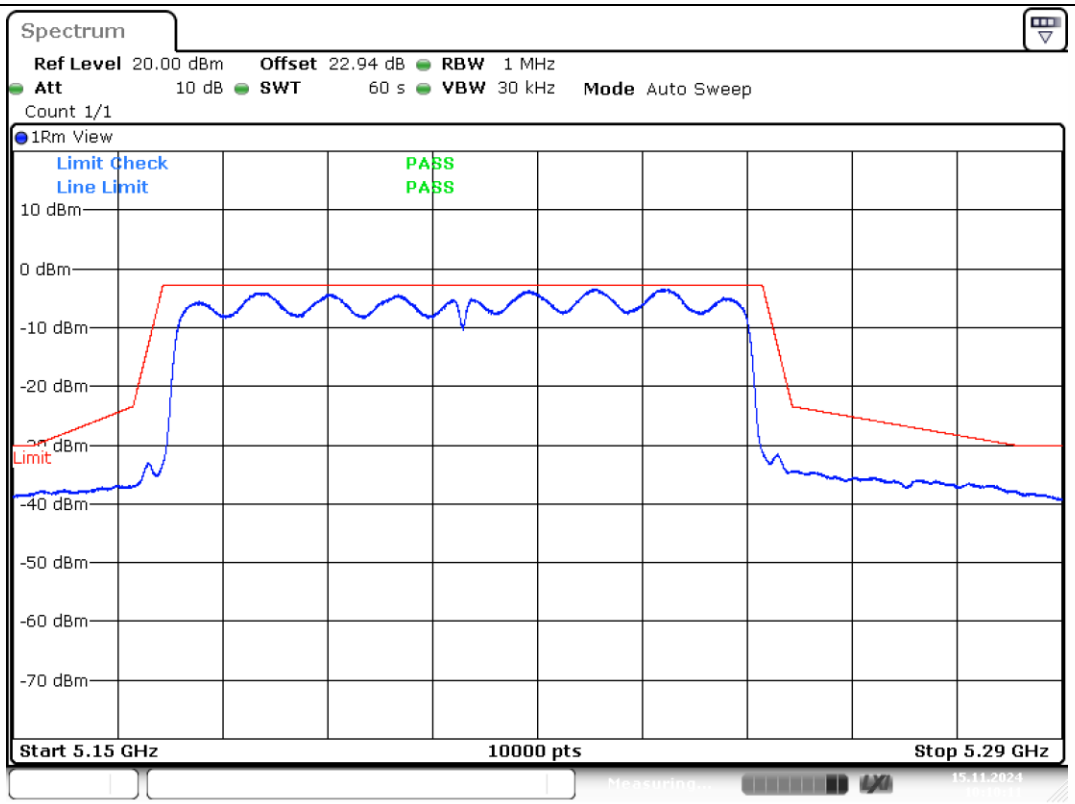


Date: 15.NOV.2024 10:10:12

NTNV-11AC80SISO-Ant1-5210-PASS

Date: 15.NOV.2024 10:11:28

8.8 RECEIVER SPURIOUS EMISSIONS

8.8.1 Applicable standard

ETSI EN 301 893 clause 4.2.5

8.8.2 Conformance Limit

The level of spurious emissions shall be measured as, either:

1. Their power in specified load (conducted spurious emissions); and
2. Their effective radiated power when radiated by the cabinet or structure of the equipment (cabinet radiation); or
3. Their effective radiated power when radiated by cabinet and antenna.

The spurious emissions of the receiver shall not exceed the values in tables in the indicated bands:

Frequency range	Maximum power, ERP	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 26 GHz	-47 dBm	1 MHz

8.8.3 Test Configuration

The measurements for receiver spurious emissions shall be performed at normal environmental conditions of the operating temperature range.

Radiated measurements shall be used for equipment.

Conducted measurements shall be used for equipment.

8.8.4 Test Procedure

Please refer to ETSI EN 301 893 (V2.1.1) clause 5.4.7.2 for the measurement methods.

● Pre-scan

The test procedure below shall be used to identify potential receiver spurious emissions of the UUT.

Step 1:

• The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in clause 4.6.2, table 4.

Step 2:

• The emissions shall be measured over the range 30 MHz to 1 000 MHz.

• Spectrum analyser settings:

- Resolution bandwidth: 100 kHz

- Video bandwidth: 300 kHz

- Detector mode: Peak

- Trace Mode: Max Hold

- Sweep Points: ⩾ 9 700

For spectrum analysers not supporting this number of sweep points, the frequency band may be segmented. For spectrum analysers capable of supporting twice this number of sweep points, the frequency adjustment in clause 5.4.7.2.1.2 (step 1, last bullet) may be omitted.

- Sweep time: Auto

• Wait for the trace to stabilize. Any emissions identified that have a margin of less than 6 dB with respect to the limits given in clause 4.2.5.2, table 5, shall be individually measured using the procedure in clause

5.4.7.2.1.2 and compared to the limits given in clause 4.2.5.2, table 5.

Step 3:

• The emissions shall now be measured over the range 1 GHz to 26 GHz.

• Spectrum analyser settings:

- Resolution bandwidth: 1 MHz

- Video bandwidth: 3 MHz

- Detector mode: Peak

- Trace mode: Max Hold

- Sweep Points: ⩾ 25 000

For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented. For spectrum analysers capable of supporting twice this number of sweep points, the frequency adjustment in clause 5.4.7.2.1.2 (step 1, last bullet) may be omitted.

- Sweep time: Auto

• Wait for the trace to stabilize. Any emissions identified that have a margin of less than 6 dB with respect to the limits given in clause 4.2.5.2, table 5, shall be individually measured using the procedure in clause 5.4.7.2.1.2 and compared to the limits given in clause 4.2.5.2, table 5.

● Measurement of the emissions identified during the pre-scan

The limits for receiver spurious emissions in clause 4.2.5 refer to average power levels.

The steps below shall be used to accurately measure the individual unwanted emissions identified during the pre-scan measurements above. This method assumes the spectrum analyser has a Time Domain Power function.

Step 1:

The level of the emissions shall be measured using the following spectrum analyser settings:

- Measurement Mode: Time Domain Power

- Centre Frequency: Frequency of the emission identified during the pre-scan

- Resolution Bandwidth: 100 kHz (emissions < 1 GHz) / 1 MHz (emissions > 1 GHz)

- Video Bandwidth: 300 kHz (emissions < 1 GHz) / 3 MHz (emissions > 1 GHz)

- Frequency Span: Zero Span

- Sweep mode: Single Sweep

- Sweep time: 30 ms

- Sweep points: ⩾ 30 000

- Trigger: Video (for burst signals) or Manual (for continuous signals)

- Detector: RMS

Adjust the centre frequency (fine tune) to capture the highest level of one burst of the emission to be measured. This fine tuning can be omitted for spectrum analysers capable of supporting twice this number of sweep points required in step 2 and step 3 from the pre-scan procedure in clause 5.4.7.2.1.1.

Step 2:

Set a window where the start and stop indicators match the start and end of the burst with the highest level and

record the value of the power measured within this window.

If the spurious emission to be measured is a continuous transmission, the measurement window shall be

set to the start and stop times of the sweep.

Step 3:

In case of conducted measurements on smart antenna systems (equipment with multiple receive chains), step 2 shall be repeated for each of the active receive chains.

Sum the measured power (within the observed window) for each of the active receive chains.

Step 4:The value defined in step 3 shall be compared to the limits defined in clause 4.2.5.2, table 5.

8.8.5 Test Results

NOTE: All the modulation modes are tested, the data of the worst mode are described in the table.

Receive in the Spurious Domain below 1GHz:

Operation Mode: ☒802.11a
Operation frequency: ☒5180MHz Temperature: 25°C
Humidity: 60 % RH Tested by: CZF

Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Margin (dB)	Verdict
37.1794	H	-74.98	-57.00	17.98	PASS
253.9208	H	-75.80	-57.00	18.80	PASS
422.7345	H	-68.50	-57.00	11.50	PASS
600.086	H	-64.17	-57.00	7.17	PASS
759.5859	H	-68.57	-57.00	11.57	PASS
979.2378	H	-67.17	-57.00	10.17	PASS
54.0608	V	-63.55	-57.00	6.55	PASS
420.4061	V	-60.50	-57.00	3.50	PASS
484.827	V	-61.04	-57.00	4.04	PASS
648.0136	V	-63.43	-57.00	6.43	PASS
720.002	V	-67.14	-57.00	10.14	PASS
984.4769	V	-68.07	-57.00	11.07	PASS

Receive in the Spurious Domain above 1GHz:

Operation Mode: ☒802.11a
Operation frequency: ☒5180MHz Temperature: 25°C
Humidity: 60 % RH Tested by: CZF

Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Margin (dB)	Verdict
3617.280	H	-63.91	-47.00	16.91	PASS
6326.366	H	-60.54	-47.00	13.54	PASS
9439.222	H	-54.41	-47.00	7.41	PASS
9619.431	H	-54.02	-47.00	7.02	PASS
12680.43	H	-53.61	-47.00	6.61	PASS
16911.09	H	-53.71	-47.00	6.71	PASS
3773.688	V	-63.66	-47.00	16.66	PASS
6159.758	V	-60.50	-47.00	13.50	PASS
9182.509	V	-54.49	-47.00	7.49	PASS
11248.11	V	-53.33	-47.00	6.33	PASS
13392.76	V	-53.26	-47.00	6.26	PASS
15415.87	V	-53.60	-47.00	6.60	PASS

8.9 ADAPTIVITY

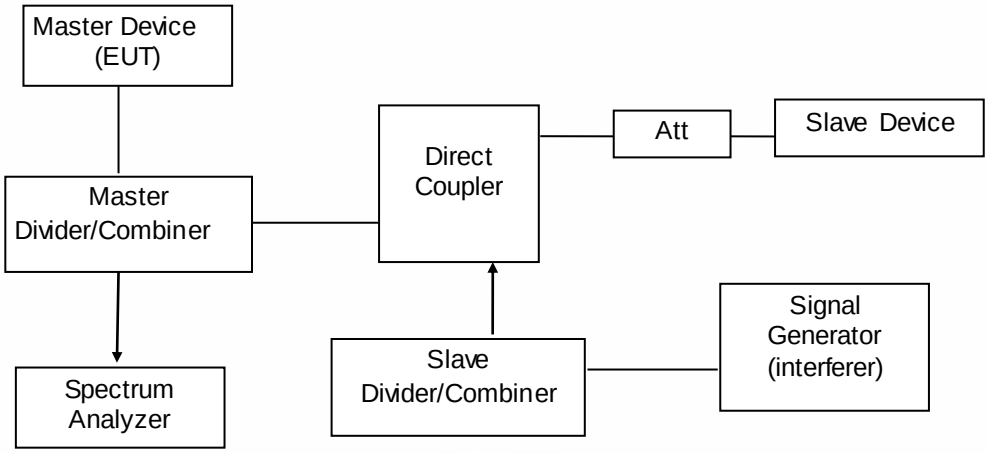
8.9.1 Applicable standard

ETSI EN 301 893 clause 4.2.7

8.9.2 Conformance Limit

● For Frame Based Equipment shall comply with the following requirement
The Clear Channel Assessment (CCA) observation time shall be less than 16 us.
The Channel Occupancy Time shall not be greater than 95 % of the Fixed Frame Period defined in point 1) and shall be followed by an Idle Period until the start of the next Fixed Frame Period such that the Idle Period is at least 5 % of the Channel Occupancy Time, with a minimum of 100 µs.
The ED Threshold Level (TL), at the input of the receiver, shall be proportional to the maximum transmit power (PH) according to the formula which assumes a 0 dBi receive antenna and PH to be specified in dBm
e.i.r.p.
For PH ≤ 13 dBm: TL = -75 dBm/MHz
For 13 dBm < PH < 23 dBm: TL = -85 dBm/MHz + (23 dBm - PH)
For PH ≥ 23 dBm: TL = -85 dBm/MHz
● For Load Based Equipment shall comply with the following requirement
The Clear Channel Assessment check observation time shall be not less than 20us.
The Maximum Channel Occupancy Time shall be less than (13/32)×qms , the value of q is selected by the manufacture in the range 4..32.
The minimum Idle Period shall be at least 5% of the channel occupancy time used in the equipment
The ED Threshold level (TL) depends on the type of equipment:
Option 1: For equipment that for its operation in the 5 GHz bands is conforming to IEEE 802.11™-2016 [9], clause 17, clause 19 or clause 21, or any combination of these clauses, the ED Threshold Level (TL) is independent of the equipment's maximum transmit power (PH). Assuming a 0 dBi receive antenna the ED Threshold Level (TL) shall be:
TL = -75 dBm/MHz
Option 2: For equipment conforming to one or more of the clauses listed in Option 1, and to at least one other operating mode, and for equipment conforming to none of the clauses listed in Option 1, the ED Threshold Level (TL) shall be proportional to the equipment's maximum transmit power (PH). Assuming a 0 dBi receive antenna the ED Threshold Level (TL) shall be:
For PH≤ 13 dBm: TL = -75 dBm/MHz
For 13 dBm < PH < 23 dBm: TL = -85 dBm/MHz + (23 dBm - PH) (3)
For PH≥ 23 dBm: TL = -85 dBm/MHz
Equipment shall consider a channel to be occupied as long as other RLAN transmissions are detected at a level greater
than the TL.
● Short control signalling transmissions
The use of Short Control Signalling Transmissions is constrained as follows:
• within an observation period of 50 ms, the number of Short Control Signalling Transmissions by the equipment shall be equal to or less than 50; and
• the total duration of the equipment's Short Control Signalling Transmissions shall be less than 2 500 µs within said observation period.

8.9.3 Test Configuration



8.9.4 Test Procedure

Please refer to ETSI EN 301893 (V2.1.1) clause 5.4.9 for the measurement method.

8.9.5 Test Results

NOTE: All the modulation modes are tested, the data of the worst mode are described in the table.

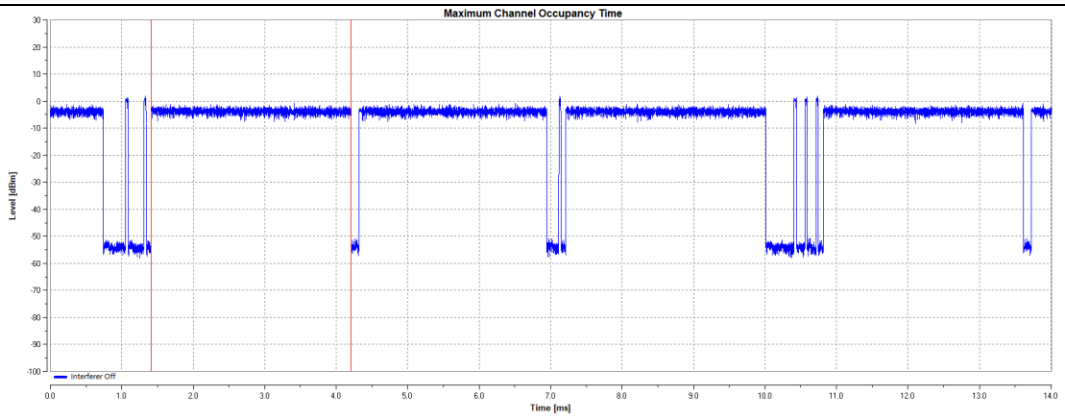
Device Style: ☐FBE ☒LBE

Temperature: 25℃ **Humidity:** 45 % RH

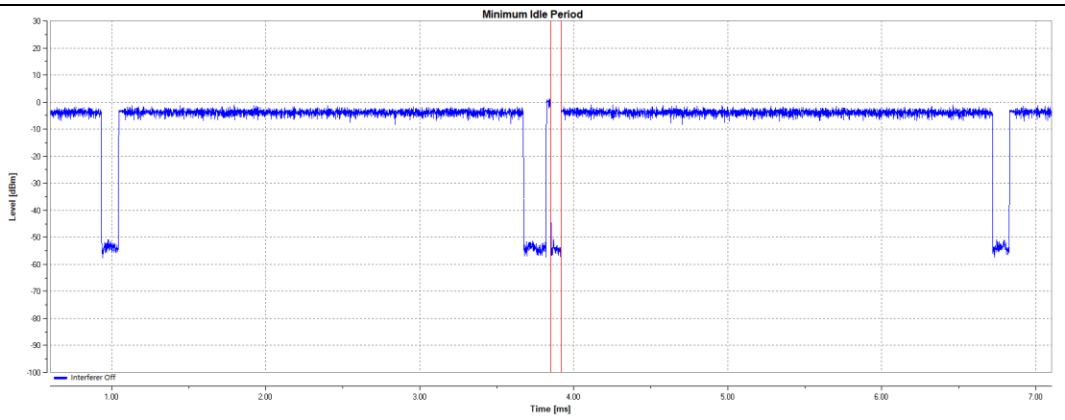
Antenna Port: 1

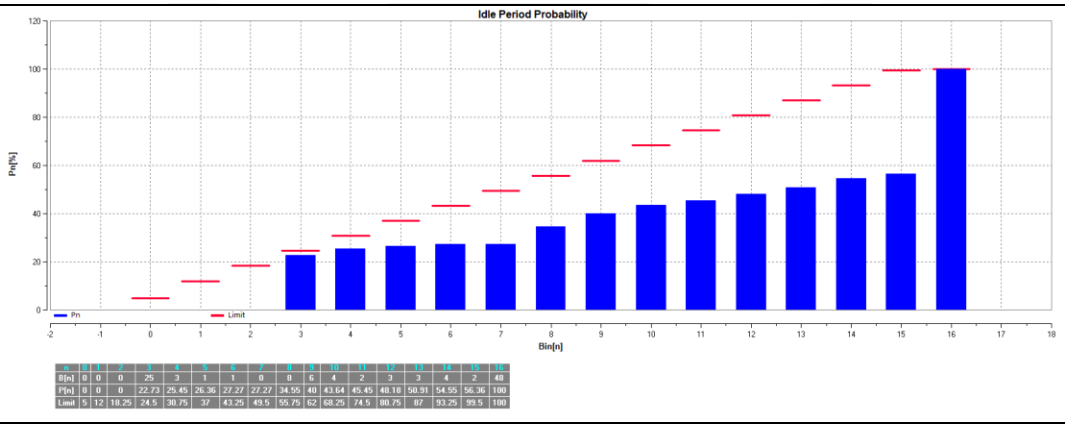
TestMode	Antenna	Frequency[MHz]	Priority Class	Max. COT [ms]	Limit [ms]	Min.Idle Time[ms]	Limit [ms]	Idle Period probability	Verdict
11A	Ant1	5180	2	2.802	6.000	0.065	0.027	See the graph	PASS

TestMode	Antenna	Frequency[MHz]	Interference Type	Add interference Time [ms]	Interference Level [dBm/MHz]	Max. Short Control number [n]	Limit [n]	Max. Short Control Time [ms]	Limit [ms]	Verdict
11A	Ant1	5180	AWGN	3001	-74.50	1	50	0.20	2.5	PASS
11A	Ant1	5180	OFDM	3001	-74.50	1	50	0.20	2.5	PASS
11A	Ant1	5180	LTE	3001	-74.50	1	50	0.20	2.5	PASS

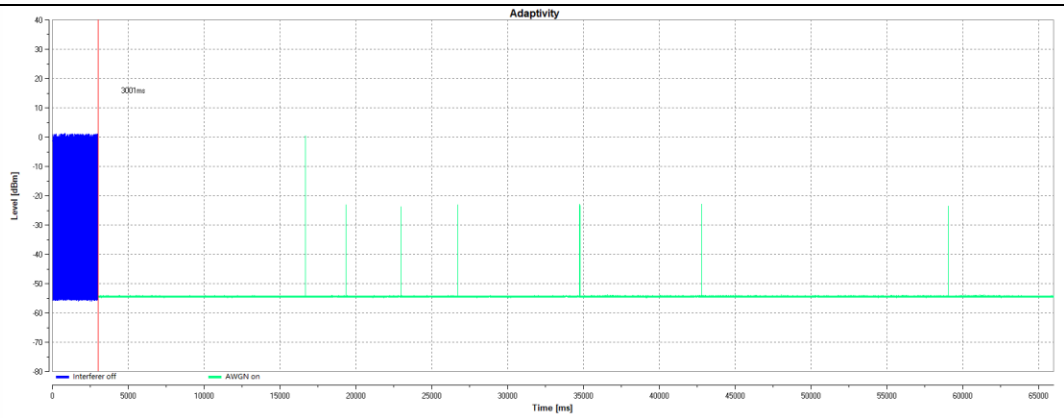


11A-Ant1-5180-PASS

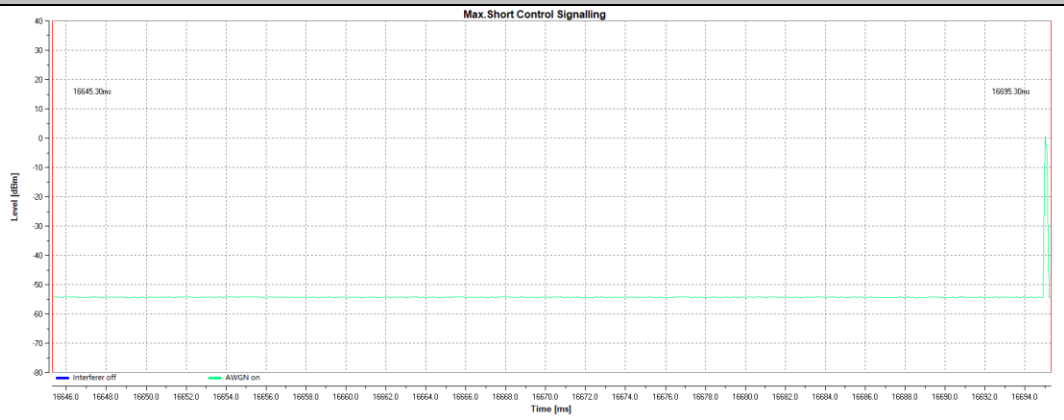


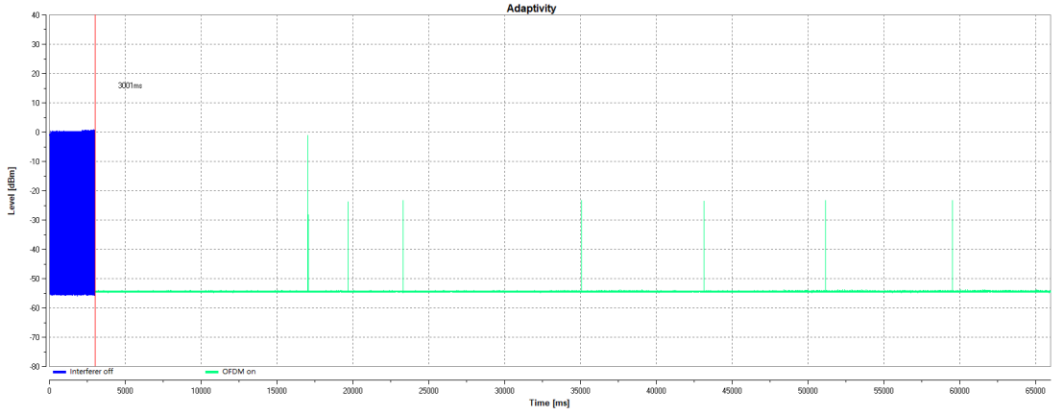


B[n]	0	0	0	25	3	1	1	0	0	0	6	4	2	3	3	4	2	48
P[n]	0	0	0	22.73	25.45	26.36	27.27	27.27	34.55	40	43.64	45.45	48.18	50.91	54.55	56.36	100
Limit	5	12	18.25	24.5	30.75	37	43.25	49.5	55.75	62	68.25	74.5	80.75	87	93.25	99.5	100

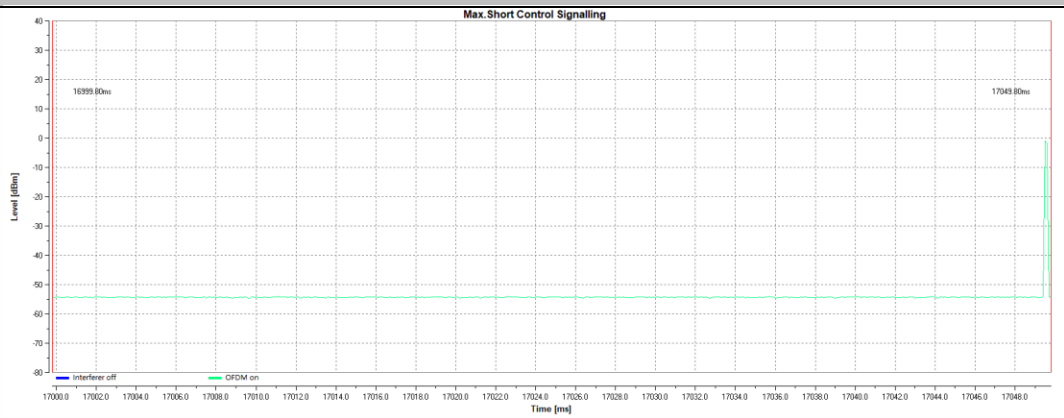


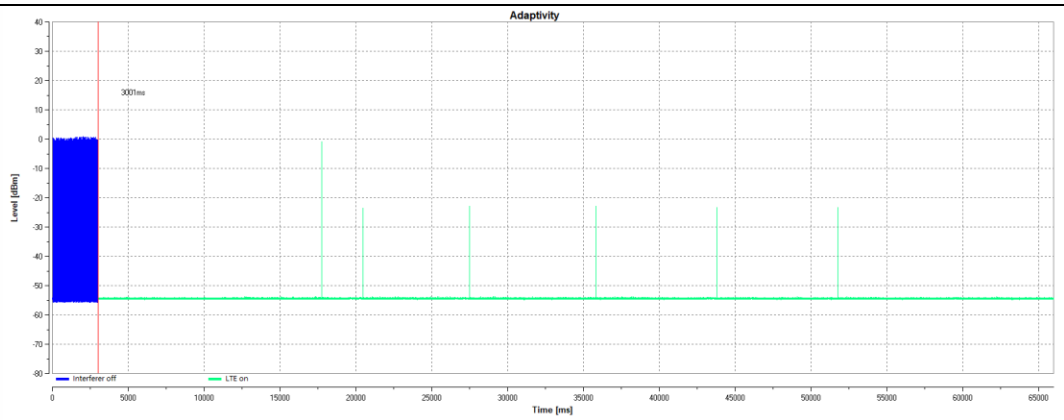
11A-Ant1-5180-PASS



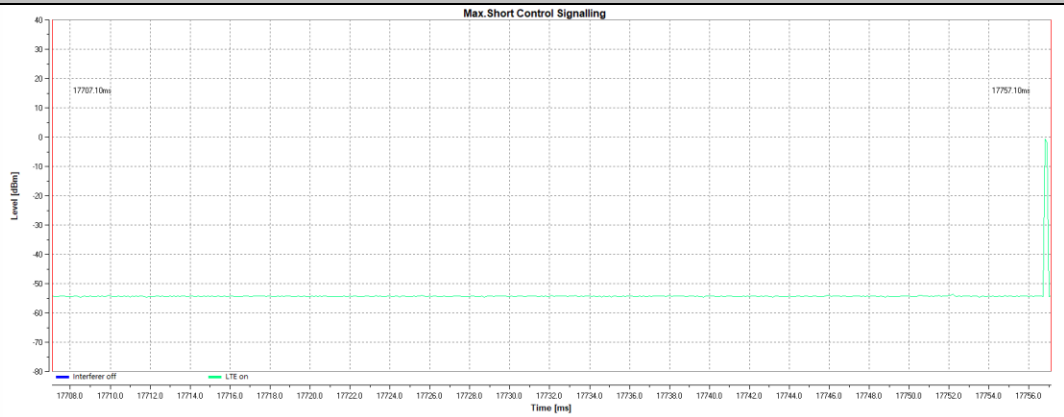


11A-Ant1-5180-PASS





11A-Ant1-5180-PASS



8.10 Receiver Blocking

8.10.1 Applicable standard

ETSI EN 301 893 clause 4.2.8

8.10.2 Conformance Limit

The minimum performance criterion shall be a PER of less than or equal to 10 %. The manufacturer may declare alternative performance criteria as long as that is appropriate for the intended use of the equipment (see clause 5.4.1,item t)).

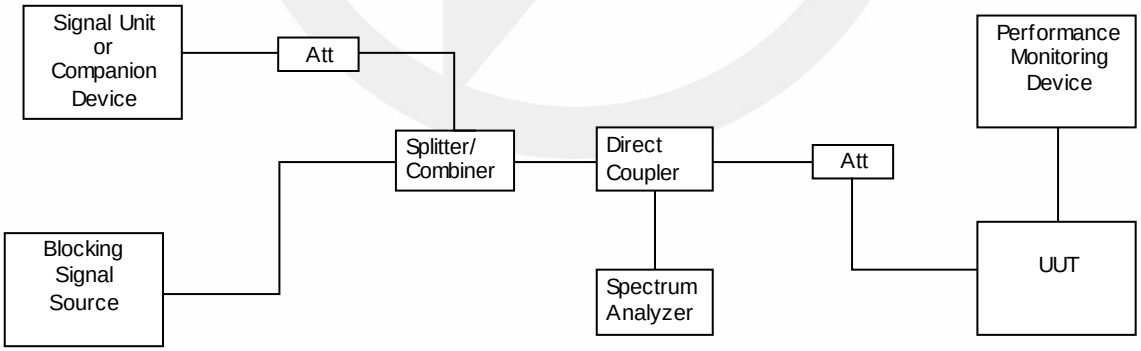
■ General

While maintaining the minimum performance criteria as defined in clause 4.2.8.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined in table 9.

Table 9: Receiver Blocking parameters

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	**Blocking signal power (dBm) (see note 2)**		Type of blocking signal
		Master or Slave signalwith radar detection (see table D.2, note 2)	Slave without radar detection (see table D.2, note 2)	
Pmin + 6 dB	5100	-57	-59	CW
Pmin + 6 dB	4900 5000 5975	-47	-53	CW
NOTE 1: Pmin is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined clause 4.2.8.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the same levels should be used at the antenna connector irrespective of antenna gain.				

8.10.3 Test Configuration



8.10.4 Test Procedure

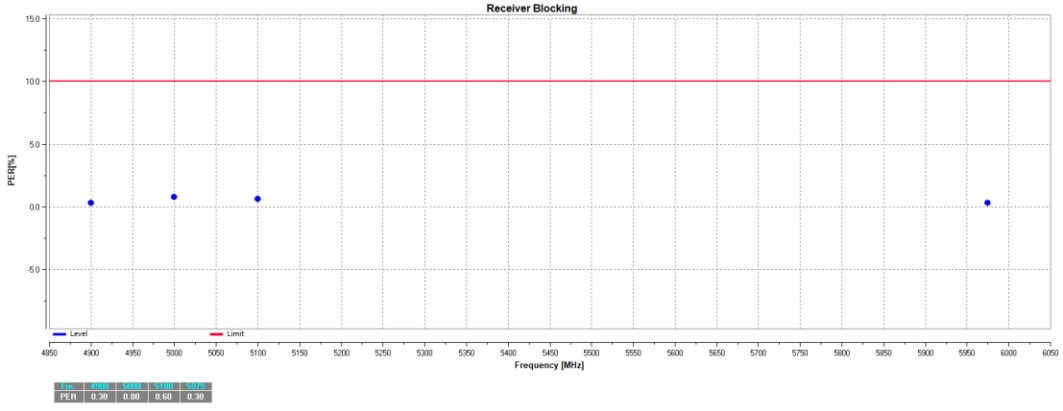
Please refer to ETSI EN 301 893 (V2.1.1) clause 5.4.10 for the test conditions.

8.10.5 Test Results

NOTE: All the modulation modes are tested, the data of the worst mode are described in the table.

Operation Mode:	☒802.11a
Test Frequency:	☒5180MHz
Device type	☒Master or Slave signal with radar detection ☐Slave without radar detection
Antenna Port:	1
Temperature:	25ºC Humidity: 60 % RH

TestMode	Antenna	Frequency[MHz]	Pmin [dBm]	Wanted signal [dBm]	Freq. [MHz]	CW [dBm]	PER [%]	Limit [%]	Verdict
11A	Ant1	5180	-88	-82	4900	-53	0.30	≤10	PASS
11A	Ant1	5180	-88	-82	5000	-53	0.80	≤10	PASS
11A	Ant1	5180	-88	-82	5100	-59	0.60	≤10	PASS
11A	Ant1	5180	-88	-82	5975	-53	0.30	≤10	PASS



11A-Ant1-5180-PASS

8.11 USER ACCESS RESTRICTIONS

8.11.1 Applicable standard

ETSI EN 301 893 clause 4.2.9

8.11.2 Conformance Limit

The equipment shall be so constructed that settings (hardware and/or software) related to DFS shall not be accessible to the user if changing those settings result in the equipment no longer being compliant with the DFS requirements in clause 4.2.6.

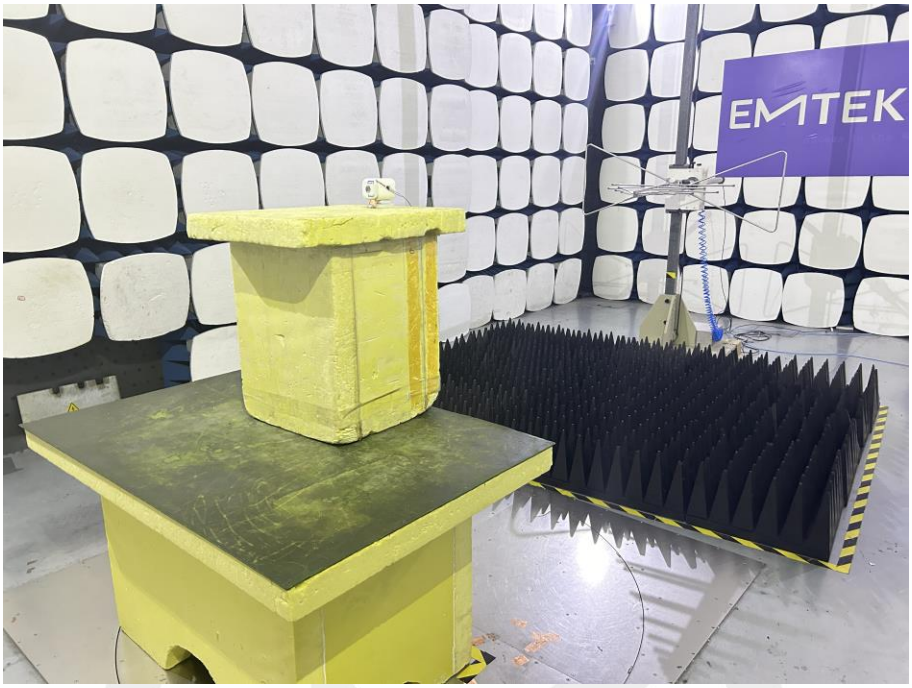
Test Results

The EUT can restraints user to restrict access to hardware and software setting of the equipment through making it be disabled and altered.

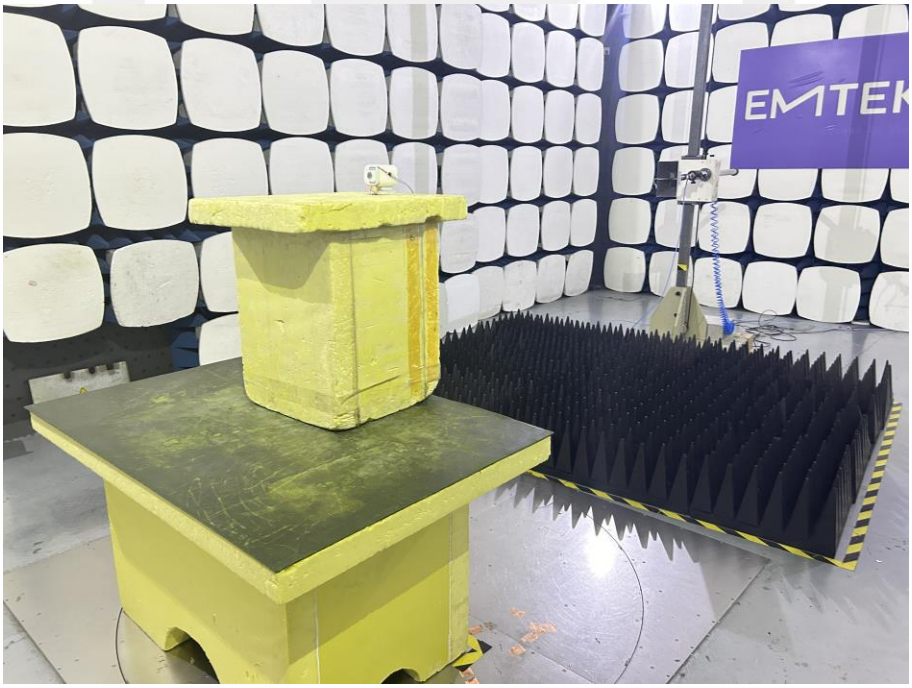
PASS

9. APPENDIX PHOTOGRAPHS OF TEST SETUP

Spurious Emission Test Setup (Below 1GHz)



Spurious Emission Test Setup (Above 1GHz)



--- End of Report ---

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